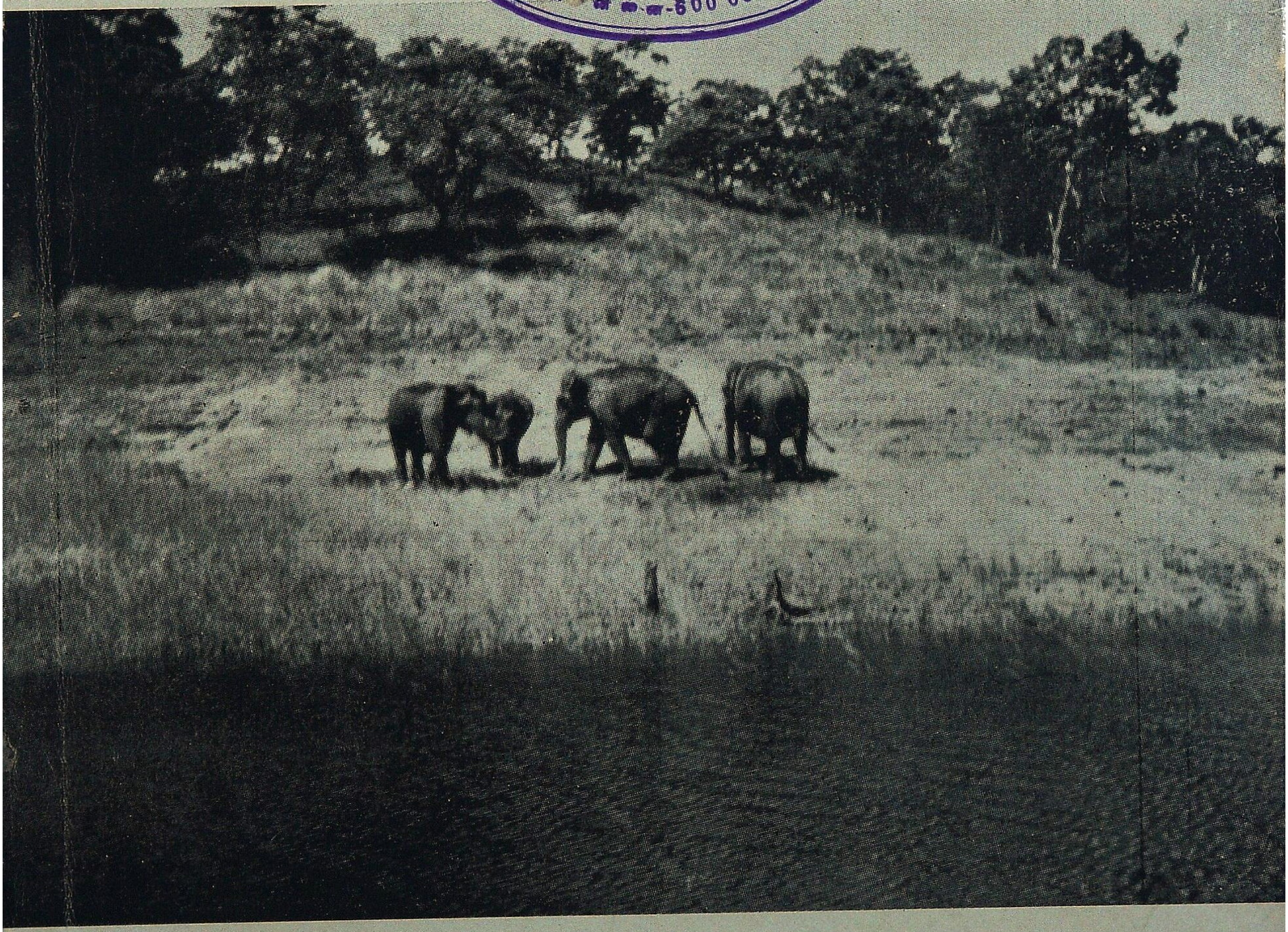
THE INDIAN FORESTER

151/88

-2 Dec 1988

30 Nov 1988
600 006

Founded in 1875



Volume 114 FEBRUARY 1988 No. 2

Telegram Indian Forester Telephone : 27021/264

INDIAN FORESTER

(A Monthly Journal of Forestry and Forestry Research)

BOARD OF MANAGEMENT

Chairman—Y G JADHAV. I.F.S., Inspector General of Forests, New Delhi.

Vice Chairman—R.V. SINGH, I.F.S., President, Forest Research Institute & Colleges, Dehra Dun.

MEMBERS

Andamans : S.S CHANA, I.F.S., Andhra Pradesh : K.V.S. BABU, I.F.S.; Arunachal Pradesh : S.B. ROY, I.F.S. Assam : S. DEB ROY, I.F.S.; Bihar : ANIRUDH TEWARY, I.F.S.; Dadar & Nagarhaveli : H.C. DHAWAN, I F S.; Goa : PANDEY B.P. SINHA, I.F.S.; Gujarat : M.N. VAISHNAV, I.F.S; Haryana : GURNAM SINGH, I.F.S.; Himachal Pradesh : I.S. KANG, I.F.S.; Jammu & Kashmir : SYED NOOR-UL-HASSAN I.F.S. : Karnataka : S SHYAM SUNDER, I.F.S.; Kerala : M. SIVARAJAN, I.F.S.; Maharashtra : U.B. PATIL, I.F.S.; Madhya Pradesh : N.K. JOSHI, I.F.S.; Manipur : B.S.K. SARMA, I.F.S.: Meghalaya : A. WAHLANG, I.F.S.; Mizoram : O.N KAUL, I.F.S.; Nagaland : D K. ZELIANG, I.F.S.: Orissa : S C. PADHI, I.F.S.; Punjab : S.K. KAPUR, I.F.S.; Rajasthan : BHARAT SINGH. I.F.S.: Sikkim : P. S. MOKTAN, I.F.S.; Tamil Nadu : S. JOHN JOSEPH, I.F.S.; Tripura : M. SARKAR, I.F.S.: Uttar Pradesh : D.B. MISRA, I.F.S., West Bengal : P. GUHATHAKURTA, I.F.S.

RULES OF MANAGEMENT

1. *Pre-payable Annual Subscription* :—

INDIA	FOREIGN	SINGLE COPY (Current and Back issue)
(Inclusive of Postage)		(Exclusive of Postage)
Rs. 150.00	$ 80.00 (By Sea Mail)	India Rs. 20.00, Foreign $ 8.00
	$ 140.00 (By Air Mail)	

Note :—Subscriptions are generally booked for a Calendar Year (JANUARY-DECEMBER), and/or from JULY-JUNE. Copies for intermediate months (of current issue) can, however, be supplied on payment, if available.

2. *Concessional Rates of Annual Subscription* (Applicable to Serving Forest Officers & Forest Scientists in Government Institutes and Government Departments in India only) :—

Those drawing a Salary of less than Rs. 2000.00 p.m. ... ... Rs. 75.00 per Annum

3. *Life Subscription* :—Forest Officers, on retirement from service in India, can obtain copies of the *Indian Forester* for life by one Single Payment of Rs. 500.00 or its equivalent. A life Subscriber will be enrolled as such hand entitled to receive copies of the Journal from the date of receipt of the full amount of his Life subscription. Request for back numbers of the Journal will not be entertained. These can, however, be supplied if available, on payment fixed for back numbers.

4. *Advertisement Tariff* :—(The rates are exclusive of blocks, etc. and are liable to change WITHOUT NOTICE). All Advertisement Matter is strictly subject to the approval of the Management.

N.B.—The Table below shows Contract Rates for and over SIX and TWELVE Insertions respectively to be consumed in one YEAR or THREE Insertions booked at a time and printed in three successive Issue of the Journal. The figures in the right-hand column denote Charges for Casual and Single Insertions.

Space	12 Insertions	6 Insertions	3 Insertions	Casual (Per Insertion)
Full Page	Rs. 3000.00	Rs. 1600.00	Rs. 900.00	Rs. 300.00
Half Page	Rs. 1800.00	Rs. 1000.00	Rs. 600.00	Rs. 200.00
Quarter Page	Rs. 1200.00	Rs. 750.00	Rs. 450.00	Rs. 160.00
2.5 cm Across Page	Rs. 1000.00	Rs. 600.00	Rs. 400.00	Rs. 140.00

Note :—(1) Extra charges over the above Rates for (*a*) Multi-Colour Insertions (up to four colour only) 75% (*b*) Double-colour (Red only or Red and Black)—25%; (*c*) Advertisement on Art Paper—25%
(2) Half-tone and Line Blocks, Stereos, and Matrices accepted. Blocks of all description and/or other Advertisements material are to be supplied by the Advertising parties themselves.
(3) screen used for Advertisements : 80—100.
(4) Only one *Voucher Copy* will be supplied Overall Size : 24 cm × 18.5 cm; Printing Size (Full-page) 20 cm × 15 cm.

Important—(*a*) Advertisement charges are strictly Payable in advance preferably by a bank Draft on State Bank of India, Dehra Dun, U.P. (India); and drawn in favour of the Business Manager *Indian Forester* (*b*), The Advertisement matter, which should be TYPEWRITTEN in BLOCK LETTERS or ITALICS, must reach us EIGHT WEEKS (10 WEEKS in case of multi-colour insertions) before the appearance of an issue for which an advertisement is intended. and should always be sent in DUPLICATE. For further particulars and of terms business please apply to the Business Manager, *Indian Forester*.

(5) Correspondence concerning subscriptions, etc., should be addressed to the Business Manager *Indian Forester*, P.O. New Forest, Dehra Dun (India). All payments on account of Subscriptions and Advertisement, etc., must, however, be made in the name of the Business Manager, *Indian Forester* and Cheques, etc., drawn in his favour.

(6) All complaints regarding delay in receipt or non-delivery of a copy or copies of the *Indian Forester* should be made WITHIN 30 DAYS from the due date of publication of an issue which is 1st of each month to the Business Manager, *Indian Forester*, P.O. New Forest, Dehra Dun. Efforts will be made to supply duplicate copy or copies of the missing number, *free of cost*, provided a complaint is received in time. and on payment if a complaint as received after 30 days subject to the availability of a copy or copies in stock in their case

(7) In case of dispute, Dehra Dun. U.P. (India), shall be the place of jurisdiction.

VOLUME 114 NUMBER 2

-2 மே 1988

151/88

THE
INDIAN FORESTER
FEBRUARY, 1988

PILOT SURVEY OF FUEL CONSUMPTION IN RURAL AREAS—V

N.M. MISRA, A.K. MAHENDRA AND M.Y. ANSARI
Forest Economics Branch,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

Consumptive behaviour of fuel in rural sector varies according to availability of firewood (supply) due to the nearness of forests. To highlight this fact Forest Economics Branch conducted pilot survey of fuel consumption in rural areas in 1974 and in 1984 for which results were published in *Indian Forester* (Chandola *et al*., 1985 and Sagar *et al*., 1985).

A similar study was made, taking into account larger number of villages mainly in three regions (as given in Table 1) to corroborate or contradict the earlier findings.

Methodology

Different villages under the three regions were surveyed and the data was collected on the same proforma already used in previous studies. The domestic consumption of non-commercial fuel viz. firewood (including brushwood) agriculture waste have been studied with the variables of occupation, size of land holding, number of cattles and family size in the different regions Villages selected under different regions are given in Table 1.

In data compilation brushwood is included in firewood. For the purpose of analysis the agricultural wastes are considered as firewood.

As measurement of land area is done in terms of local unit called Nali, hence the unit 'Nali' is used in this study. (1 hectare= 50 Nalis approximately).

Population

For maintaining uniformity in data villages of almost similar socio-economic status have been selected for the study. All the families of each village were surveyed for the study. Table 2 gives demographic structure of the 3 regions. On the average there is no significant difference in the 3 regions with regard to their family size, income and land holding etc.

Number of large size families is not frequent in all the three regions which is attributed to the gradual disappearance of joint family system even in remote villages.

Table 1

Villages surveyed under different regions

Region	Particulars	Villages
I	Villages surrounded by forests.	1. Jhair Chota (Distt. Pauri) 2. Jhair Bada -do- 3. Vijay Pur -do- 4. Manjeli (Distt. Tehri)
II	Villages near the forests.	1. Singtali (Distt. Tehri) 2. Atali -do- 3. Shiv Puri -do- 4. Chameli -do-
III	Villages away from the forests.	1. Talai (Distt. Tehri) 2. Dhaur -do- 3. Bhesark -do-

Table 2

Demographic structure of different regions

Region	Number of families surveyed	Total population	Average per family		
			Members	Annual income (thousand rupees)	Land (Nalis)
I	48	292	6.08	7.86	44.17
II	87	669	7.69	7.79	58.04
III	75	460	6.13	7.41	37.86

More than 50% of the population have family size of 5 – 7 members. Average family size is 6.53. Also there is hardly any difference in average income per family in all the regions. Most of the families earn between 6 – 7 thousand rupees per year and average annual income comes to 7.67 (thousand) per family.

Table 4 describes in short the number of families by occupation.

Land Distribution

Although all the families are in possession of land, but their economic position is not sound due to poor returns from agriculture. Lands are mostly

Table 3

Distribution of families by size classes

Family size	Region I	II	III
1	1	4	2
2	2	3	5
3	1	3	7
4	4	2	8
5	11	14	10
6	11	15	20
7	9	9	7
8	5	6	5
9	1	7	2
10	1	8	2
11	1	2	1
12	—	5	3
13	1	2	1
13+	—	7	2
Total	48	87	75

infertile, slopy and fragmented and thereby decreasing the production. Average size of land per holding is around 46.69 Nalis. The range of distribution is in between 21 - 60 nalis/family. Almost all the families mainly depend on agriculture even though below 10% of land is under irrigation (Khandekar, 1986).

Cattle

The cattle population in all the three regions is quite high. Every family keeps some cattle and their fodder is collected from neighbouring areas— by the family members. As no scientific and systematic animal husbandry is practised the extent of milk yield is reported to be negligible. The return from cattle is only dung. Estimation of dung production is based on the assumption that two calves excrete as much dung as one animal and a cow, a buffalow and a bullock excrete same

Table 4

Distribution of families by occupation

Occupation	Region I	II	III
Agriculture	4 (8)	16 (19)	4 (6)
Agriculture & Service	32 (67)	34 (39)	26 (35)
Agriculture & Artisan	— —	2 (2)	6 (8)
Agriculture & Labour	6 (13)	7 (8)	21 (28)
Agriculture & Business	1 (2)	13 (15)	1 (1)
Agriculture, Service & Artisan	— —	2 (2)	3 (4)
Agriculture, Service & Labour	3 (6)	2 (2)	12 (16)
Agriculture, Service & Business	2 (4)	8 (10)	1 (1)
Agriculture, Artisan & Labour	— —	— —	1 (1)
Agriculture, Artisan & Business	— —	1 (1)	— —
Agriculture, Labour & Business	— —	1 (1)	— —
Agriculture, Service, Labour & Business	— —	1 (1)	— —
Total	48 (100)	87 (100)	75 (100)

Note : Figures within paranthesis indicate percentages.

quantity of dung by 10 kg per day we derive a production of 97.25 quintals of wet dung per day for manural purposes. Per family the production comes to 0.46 quintal per day (or 168.57 quintal per year).

Table 5

Number of farmers according to land classes

Land classes (Nali)	Region		
	I	II	III
0–20	4	4	14
21–40	19	33	44
41–60	20	25	11
61 and above	5	25	6
Total	48	87	75

Table 6

Cattle distribution

Cattle	Region		
	I	II	III
Bullock	67	203	117
Buffalow	53	107	95
Cow	64	79	71
Calf	59	95	79

Firewood

Firewood is the main fuel in all the three regions. Their easy access for collection from nearby forests has not allowed the villagers to resort to the use of some other fuel for domestic consumption except a very little variation in region III where some families use some percentage of other fuel than firewood. About 79% of families in region III consume more than 4 quintals of firewood per month while in region II such families are only 71% and in region III only 4%. It clearly indicates that more the distance of forests from the villages less is the quantity of firewood consumption.

Agriculture wastes

This fuel consists of mainly agricultural wastes e.g. roots of sugarcane and stems of pulse plants and plants grown on the boundary of the cultivated lands. This fuel is not consumed in region I and II very much because firewood is available in abundance. In the region III this is used as fuel to some extent. Large proportion of families consume less quantity of agricultural waste. The average consumption is of the order 10.98 quintals per family i.e. 1.79 quintals per head per annum. In this region 43% families are consuming less than 1 quintal of agricultural waste per month and 17% families do not consume agricultural waste. Scarcity or some difficulty in procuring firewood has compelled villagers to use agricultural waste as fuel. Even then it is not a very popular fuel in this area.

Pattern of fuel consumption

Families consume firewood 100% in region I and II while in the region III families consume firewood 71% and agriculture waste 29%. In the III region there is some difficulty in procuring firewood. One more significant difference observed in these all the regions' villages is that there is not even a single family which consumes dung as fuel. 100% dung production is used for manural purposes.

Conclusion

1. Nearness of the forests increases per capita fuelwood consumption.

2. Difficulty in procuring firewood often compels villagers to use other alternatives. Hence in the region III agricultural waste is also used to some extent.

3. Dung is compeletely used for manural pruposes. Not even a single family was noticed using dung cake as fuel.

Table 7

Firewood consumption (including brushwood)

Quintal per month	Region					
	I		II		III	
	No. of families	%	No of families	%	No. of families	%
Upto 1	—	—	—	—	2	3
1 - 2	1	2	6	7	30	40
2 - 3	2	4	4	5	25	33
3 - 4	7	15	15	17	15	20
4 - 5	11	23	21	24	2	3
5 & above	27	56	41	47	1	1
Total	48	100	87	100	75	100

Table 8

Consumption of Agricultural waste in Region III

Quintal per month	No of families	%
Upto 1	32	43
1 - 2	22	29
2 - 3	6	8
3 and above	2	3
Families not consuming agricultural waste	13	17
Total	75	100

Table 9

Per capita fuel consumption (kg/day)

Fuels	Region		
	I	II	III
Firewood	2.95 (100)	2.31 (100)	1.26 (71)
Agricultural waste	—	—	0.51 (29)
Total	2.95 (100)	2.31 (100)	1.77 (100)

Figures in brackets are percentage.

Acknowledgement

The authors are grateful to the Village Pradhans for their kind cooperation in collecting the data.

SUMMARY

Pilot survey of fuel consumption in rural areas was conducted by the Forest Economics Branch, FRI in 1974 and again in 1984 in the regions :

1. Region I Villages surrounded by forests
2. Region II—Villages near the forests
3. Region III Villages away from the forests

The present study pertains the villages in the hilly areas. In villages of region I and II firewood is the only fuel used in the domestic sector while the position is different in the region III where agricultural waste is also used as fuel. Not even a single family was found using dung cake as fuel. Per capita fuel consumption is the highest in the region I and lowest in the region III according to difficulty in procuring wood. Per capita non-commercial fuel consumption varies with respect to profession, family size and land area available with the family. Shortage of alternative sources is evident.

ग्रामीण क्षेत्रों के ईंधन उपयोग का दिग्दर्शी सर्वेक्षण

एन०एम० मिश्र, ए०के० महेन्द्रा व एम०वाई० असारी

सारांश

वन आर्थिकी शाखा, वन अनुसंधान सस्थान ने 1974 में और फिर 1984 में निम्न क्षेत्रों में स्थिति ग्रामीण क्षेत्रों के ईंधन उपयोग का निग्दर्शी सर्वेक्षण कराया था।

1—प्रथम क्षेत्र- वनों से घिरे हुए गांव
2—द्वितीय क्षेत्र– वनों के निकट बसे गांव
3—तृतीय क्षेत्र– वनों से दूर हटे गांव

प्रस्तुत अध्ययन का सबन्ध पहाड़ी क्षेत्रों के गांवों से है। प्रथम और द्वितीय क्षेत्रों के गांवों में घरेलू क्षेत्रों में उपयोग में लाया जाने वाला ईंधन लकड़ी ही है, परन्तु तृतीय क्षेत्र की हालत इससे भिन्न है; वहां ईंधन के लिए कृषि क्षेप्य भी काम में लाया जाता है। एक भी परिवार ऐसा नहीं मिला जो ईंधन के लिए उपले न जलाता हो। प्रति व्यक्ति ईंधन उपभोग प्रथम क्षेत्र में अधिकतम है तथा तृतीय क्षेत्र में न्यूनतम जो लकड़ी मिलने में कठिनाई के अनुसार ही है। प्रति व्यक्ति गैर-व्यापारिक ईंधन उपभोग में पेशे, परिवार का आकार और परिवार के पास रहे भूमि क्षेत्र के अनुसार अन्तर पाया जाता है। वैकल्पिक स्रोतों की कमी स्पष्ट ही है।

References

Chandola, L.P., A.K. Mahendra and M.Y. Ansari (1985). Pilot Survey of fuel consumption in Rural Areas III. (Village Karaundi resurveyed). *Indian For.*, **111** (4) : 208-214.

Sagar, S.R., L.P. Chandola and M.Y. Ansari (1985). Pilot Survey of fuel consumption in Rural Areas IV. *Indian For.*, **111** (5) : 305–317.

Shrikant Khandekar (1986). "Paharon se vidai ki hook"—A Report, *India Today* (Hindi) December, 15.

———

GERMINATION AND NURSERY TECHNIQUE OF FOUR SPECIES OF *FICUS*

S.N. RAI, H.C. NAGAVENI AND H.S. ANANTHA PADMANABHA

Sandal Research Centre, Bangalore (Karnataka)

Introduction

Ficus species are important fodder, fuel and small timber yielding trees. Most common method of propagation at present is by planting stem cuttings, since adequate information on propagation through seed is not available. The nursery technique described by Troup (1921) and Singh (1982) are not the best methods to give assured success. *Ficus* seedlings, during the early stage of development, are very tender, therefore normal method of raising of seedling as in case of other tree species does not give the desired results. *Ficus* seedlings need more care in handling as they succumb to excess moisture conditions also.

A detailed and practicable method of seed collection, processing and cultivation of four species, *Ficus mysorences*, *Ficus bengalensis*, *Ficus glomerata* and *Ficus religiosa* have been reported here.

Materials and Methods

Most *Ficus* species bear fruit from March to July. The seeds are collected from fruits of different stages of maturation, which can be identified from their colour; ripenning fruits are yellow, moderately ripe fruits are brownish yellow and fully ripe fruits are cherry brown.

The fruits collected from the trees were squeezed in water; seeds that floated were collected and dried on blotting paper under shade for a few days. Seed weight from fruits of all the categories was determined. The following pre-treatments to seeds were given to improve the germination.

(a) Hot water (60°C) soaking for 10 minutes.
(b) Water (room temperature) soaking for 2 hours.
(c) Ethrel (50 PPM) soaking for 2 hours.
(d) Gibberallic acid (100 PPM) soaking for 2 hours.
(e) Thio-urea (100 PPM) soaking for 2 hours.
(f) Hydrochloric acid (0.3%) soaking for 2 hours.
(g) Control-dry seeds sown as such.

Seeds of all categories were germinated in bed of sand or sand and red earth mixture (2 : 1 ratio). The dried seeds were mixed with twice the quantity of fine sand so as to facilitate easy broadcasting. Germination started after a week and was over in two weeks.

Results and Discussion

It was noticed that the seeds collected from the brownish yellow fruits gave maximum germination compared to the fully ripe fruits which were cherry brown or unripe fruits which were yellow in colour (Table 1). Most of the seeds obtained from fully ripe fruits were hollow and infested

with insects. The number of seeds per gram also varied considerably depending on the colour of the fruit as the unripe seeds have higher moisture content than fully ripe seeds.

It is evident from the result that moderately ripe fruits gave more germination ranging from 18–20 per cent in comparison to other two categories.

The results of pre-treatment of seeds indicate that the germination percentage can be moderately increased by treating the seeds with hot water (60°C) for 10 minutes. The other pre-treatments did not influence the seed in any manner in promoting germination. On the contrary, Ethrel, Thio-urea and Hydrochloric acid showed inhibitory effect (Table 2).

Table 1

Number of seeds and germination percentage in four Ficus species

Colour of the fruits	Number of seeds (per gram)				Germination per cent (after 2 weeks of sowing)			
	Fm	Fb	Fg	Fr	Fm	Fb	Fg	Fr
Yellow	1370	2080	2250	2300	13	14	14	15
Brownish	1400	2200	2000	2500	18	20	19	20
Cherry brown	1600	2500	1900	2800	15	15	13	14

(Results are the average of five replication)

Fm – *F. mysorences*, Fb – *F. bengalensis*, Fg – *F. glomerata*, Fr – *F. religiosa*.

Table 2

Pre-treatment and germination in four Ficus species.

Pre-treatment	Duration	Germination per cent (after 2 weeks of sowing)			
		Fm	Fg	Fb	Fr
Hot water (60°C)	10 minutes	30	28	24	25
Cold water (room temperature)	2 hours	20	20	22	21
Gibberellic acid 100 PPM	2 hours	18	21	20	20
Ethrel 50 PPM	2 hours	10	12	13	20
Thio-urea 100 PPM	2 hours	10	9	10	9
Hydrochloric acid 0.3%	2 hours	5	7	2	5
Control	—	18	19	20	20

(Fm, Fg, Fb, Fr = as given in Table 1).

Germination started in 7-8 days of sowing and was complete within 15 days. The seed has a short viability of around 30 days.

Maithani *et al.* (1987) studied maturity, pre-treatment and germination of seeds of *Ficus benjamina*. They found the best germination from yellowish brown seeds which is a ripe but not over ripe stage. They also reported very poor germination from seeds obtained from bat droppings (which contain seeds from fully ripe fruits). They did not find any appreciable increase in germination from the pre-treatments that they tried.

Nursery Technique

Dried seeds were mixed with fine sand (1 : 4 ratio) and broadcasted in a seed pan. The seeds were just covered with a thin layer of sand. Sand and red earth mixture (2 : 1 ratio) was found suitable for the seed pan than mere sand because the developing seedling needs a firm grip for the roots. Sand had a tendency to give way and the slender roots were disturbed frequently at the time of watering. On account of this, seedlings had tendency to fall and wither away.

Since most of the seeds germinated in about 15 days, the seed pan gave an appearance of a mat of seedlings. The close germination was favourable to the seedlings because watering did not dislodge them. In cases, where germination was sparse it was noticed that slight excess watering disturbed the seedlings leading to their death. These seedlings grew to a height of 1 to 1.5 cm in 30 days (Stage I).

It is difficult to identify various *Ficus* species at this stage of development as their leaves look alike. Sowing seeds in trays was found better compared to sand beds in the field. (Sowing seed on ridges – in a ridge and furrows seed bed – did not give better germination). The prevalent practice of sweeping the ground below the trees to collect fruits of *Ficus* and broadcasting it on the seed bed was also not found desirable as the sweepings contained large proportion of seeds obtained from ripe fruits, which have poor germination per cent. Majority of these seeds were non-viable and hollow, which on absorbing moisture developed saprophytic micro-organisms which were harmful for the developing seedlings.

The method recommended by Troup (1921) of transplanting the tiny seedling in the nursery beds at young stage and regularly weeding them is not really practicable, since at the early stage of development the leaves of weeds and *Ficus* species cannot be differentiated easily. In addition to this, application of water to the seedlings in beds is a very delicate job; the seedlings do not tolerate heavy watering. Even the rose can watering did sometimes damage the seedlings. The leaves of seedlings come in contact with soil surface during the process of watering and get stuck; later they are not able to recover.

The second stage of transplanting into the pots in clumps is an improved technique over Troup (1921). In the trays when the seedlings have grown profusely like a mat they cannot be kept for over 30-40 days, because of competetion. Removing single seedling is a difficult and risky proposition as they do not tolerate or stand transplanting. The seedlings trans-

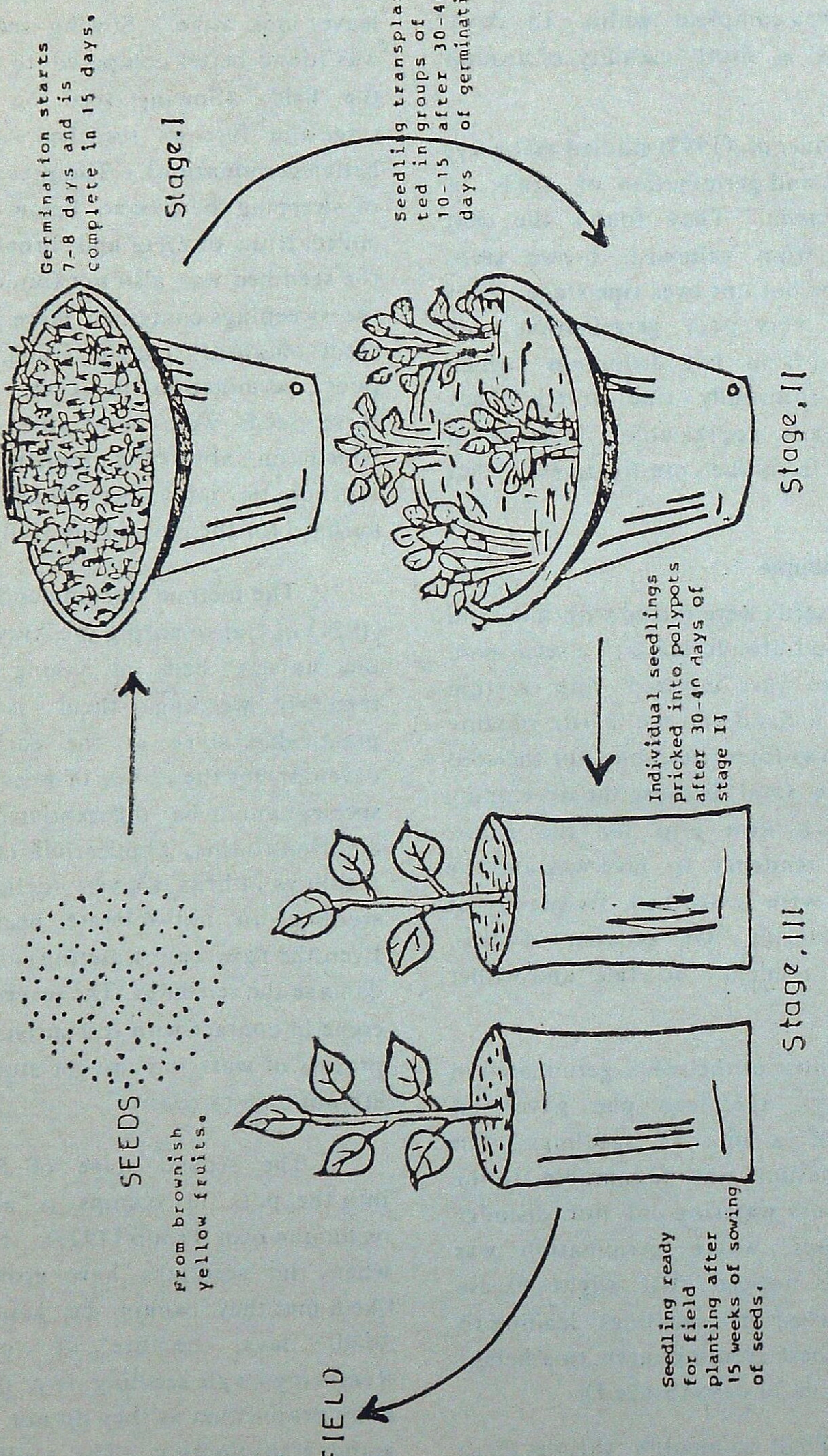


Fig. 1.

Propagation of *Ficus* from seed.

planted in groups of 10 to 15 along with the attached soil into another seed pan or container proved very successful (Stage II).

These seedlings were maintained for about 30-40 days, by that time they attained a height of 4 to 6 cm with slightly erect shoot with 4 to 6 pairs of leaves. The seedlings were maintained with slight dryness of the soil condition. These seedlings were pricked out into polybags or other containers individually. These seedlings withstood shock and excess moisture (Stage III).

Watering was an important factor during the development of a seedlings of *Ficus*. Over watering was avoided and water was given from the sides of the container and not directly on the top of the seedlings since the shoot systems were very weak. Both stages of transplanting must be provided shade for atleast the first one week.

Benlate (0.01%) solution once a month was given to the seedling to avoid any fungal infection.

By following the above technique as illustrated in Fig. 1 it was possible to raise large number of seedlings. The belief that the *Ficus* seedlings come up in the crevices and on the tree trunks without any effort is a myth, since hardly one or two develop out of the thousands that are wasted.

Conclusions

1. Brownish yellow fruits are the right type of mature fruits to be collected for good seed collection.
2. Germination per cent varies from 25-30 and seeds are viable for 30 days.
3. Pre-treatment with hot water (60°C for 10 minutes) gives good germination.
4. Seedlings are to be raised in boxes or in seed pan with sand and red earth mixture.
5. Seedlings should be transplanted in clump after 30 to 40 days. Individually transplanted seedlings at this stage may not survive.
6. After keeping the seedlings in the clump stage for 30 to 40 days the individual seedlings can be pricked out into polythene bags or other containers.
7. Watering is to be done very judiciously and excessive moisture to be avoided at all stages of development of seedlings.

SUMMARY

The study reports information on *Ficus bengalensis*, *F. glomerata*, *F. mysorences* and *F. religiosa*. It is observed that moderately ripe fruits which are brownish yellow in colour gave the best germination and soaking the seeds for 10 minutes in hot water at 60°C gave the highest germination per cent. It was found that the young seedlings are too delicate to be transplanted individually, therefore in the first stage they are transplanted in bunches and thereafter pricked out individually. Providing shade for initial one week at both the stages of transplanting is essential. Excess watering results in mortality. Pre-treatment and nursery technique of the four *Ficus* species is reported.

फाइकस की चार जातियां उगाने की अंकुरण व रोपणी प्रविधि

एस०एन० राय, एच०सी० नागवेणी व एच०एस० अनन्थ पद्मनाभ

सारांश

इस अध्ययन में फाइकस बेंगालेंसिस, फा० ग्लोमेराटा, फा० माइसोरेंसिस और फा० रिलिजिओसा के विषय में जानकारी दी गई है। देखने मे आया है कि मध्यम पके फलों का, जिनका रंग भूरापन लिये पीला रहता है, अंकुरण सबसे अच्छा होता है, और 60 से० तापमान वाले गर्म पानी में बीजों को दसलेमिनट भिगोया रखने पर बोने से सर्वोत्तम अंकुरण प्रतिशत रहा। यह भी देखा गया कि छोटे पौधे एक-एक करके प्रतिरोपित करने के लिए कोमल रहते हैं, इसलिए पहले चरण में उन्हें गुच्छों में प्रतिरोपित किया जाता है और कुछ समय पश्चात् बाद में अलग-अलग रोप दिया जाता है। प्रतिरोपण के दोनों चरणों में एक सप्ताह तक पौधों को छाया देना अनिवार्य है। पानी अधिक देने से पौधे मर जाते हैं। चार फाइकस जातियों का पूर्वोपचार और रोपणी प्रविधि भी सूचित किए गए हैं।

References

Maithani, G P., V.K. Bahuguna and O P. Sood (1987). Maturity indices and pre-treatment studies on the seeds of *Ficus benjamina*. *Indian For.*, **113** (1), : 6-9.

Singh, R.V. (1982). *Fodder Trees of India.* Oxford and IBH Publishing Co., New Delhi, pp. 1–663.

Troup, R.S. (1921). *The Silviculture of Indian Trees.* Vol. III, Clarendon Press, Oxford, pp. 735–1195.

AN EVALUATION OF *EUCALYPTUS* INTRODUCTION TRIALS AT NEW FOREST, DEHRA DUN

M.G. GOGATE* AND U.D. DHAUNDIYAL

Directorate of Silviculture Research,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

Eucalypts are credited with high growth rate and multiple use and being planted extensively. The eucalypt group encompasses wide geographical range and wide spectrum of agro-climatic conditions. Though the group includes some species which have wide distribution range, majority of them occupy specific agro-climatic zones/ geographical locations. It is expected that the group will readily provide one or more suitable species for any specific area outside its natural range, except for the cold temperate and boreal tropical rain forest regions (FAO, 1979).

Eucalypts in India

With the claim of fast growth rate, adaptability and multiple uses, Eucalypts have engaged attention of Foresters in India for almost over a century. Initial success of *E. globulus* in the Nilgiri hills and *Eucalyptus* 'Hybrid' in Karnataka, probably motivated the Foresters to explore the possibility of introducing *Eucalyptus* in other areas as well. Based on account of 74 introductions made, a tentative list of promising species for different regions was made in early 20th Century (Troupe, 1921). May be, because of despondent views of some of the leading foresters of the day (i.e. Parker's view that "idea to use *Eucalyptus* for forest plantation can safely be abandoned"), these trials were not followed up to its logical conclusion. The UN–FAO study tour in 1952 to Australia once again focussed attention on *Eucalyptus* (Thirawat, 1956). Eucalypts gained prominance once again for their potential as a source of fuelwood and raw material for the paper and pulp industries as evidenced by the efforts to select suitable *Eucalyptus* for different locations made at the national level (Sahni 1961; Khan & Chowdhary, 1961; Qureshi, 1967) and regional levels i.e. arid zone (Kaul and Ganguli, 1962; Kaul and Jain, 1967; Mathur, 1961), Orissa (Das, 1961), West Bengal (Ghosh, 1961), Kerala (Iyppu, 1961), Mysore (Kaikini, 1961), Madhya Pradesh (Kamath, 1967), Uttar Pradesh (Pande, 1961) etc. The tempo of *Eucalyptus* plantation gained momentum under plan programme and have been planted extensively judging from the coverage of 4.1 lakh ha till 1974.

Though over 170 species/varieties of *Eucalyptus* have been introduced in India

* Presently Field Director, Project Tiger Melghat, Paratwada (Maharashtra).

(Mathur, 1983), it is only the so called "*Eucalyptus* hybrid", which is now recognised as unspecified provenance of *E. tereticornis*; received more attention. *E. tereticornis* has wide range of adaptability, as can be seen from its extension almost throughout the country covering varied edapho - climatic condition. Other Eucalypts include *E. camaldulensis*, *E citriodora*, *E. globulus* and *E. grandis*. Performance of *Eucalyptus* introductions has, however, belied the expectations. Though being rated as a fast growing species in average site quality areas i.e. site quality III/IV or IV which are normally available for afforestation, the hybrid provides hardly 3-4 m^3/ha/ann. (Chaturvedi, 1983). Only recently the Eucalypts have entered agricultural lands/ farm bunds in a big way and correct assessment of their performance on such lands is yet to be made. The Indian sub-continent which has a very wide range of agro-climatic conditions on account of its peculiar features, selection of appropriate Eucalypts for each of the climatic zones would, thus, entail a very exhaustive trials. This would not only require large inputs by way of funds, and trained personnel, but also import of large quantity of planting material from Australia It will also require considerable time. It was, therefore, suggested that on the basis of experiences gained from the introductions made so far, a simple key to narrow down the choice of species be evolved (Gogate, 1984). Despite large number of attempts made in the past, there is thus, still scope to improve upon the choice of species selected for planting.

Introduction trials at Forest Research Institute, Dehra Dun, 1974–1975

A study to compare performance of different *Eucalyptus* species under Dehra Dun conditions was initiated at the Forest Research Institute in 1974-75. Seeds received from abroad and those collected within the country from time to time, were sown in the nursery. Usual nursery practices were adopted and seedlings raised in the beds were transplanted in the polythene bags. There was variation in the height of seedling (15 to 150 cm) at the commencement of field trial.

To reduce the variation between the initial heights of seedlings, the seedlings were broadly divided into two separate groups i.e. height 15-75 cm & 75 to 150 cm.

The first group included the following species: *astringens, botryoides, dalrympleana, ficifolia, leucoxylon, longifolia, melanophloia, tereticornis, polybractea, populnea, robusta, rudis, saligna, sideroxylon.*

The second group included following species: *camaldulensis, bicostata, diversicolor, grandis, hybrid, maculata, staigeriana, tereticornis, citriodora.* At subsequent stage, however there appeared to be no significant difference and thus here no distinction is made between the groups.

For each experiment randomized block design with four replications was adopted. Each plot contained nine seedling planted at the spacement of 2 m × 2 m. Normal practice of replacing casualty in the first growing season was adopted. In the second year also casualty replacement was made, where planting stock of appropriate species was available. After the 2nd growing

season no replacement was made. As under average forestry conditions, there were no inputs by way of irrigation or fertilisers and weedings after the 2nd year; grazing by stray cattle was not excluded completely.

The Performance of these trials was evaluated in 1984. It was noticed that possible errors had been made during casualty replacement in the second year and all such plants which did not match with the given treatment were excluded. Survival, total height and diameter (b.h o.b.) was recorded for all the plots and their weighted averages were worked out.

To give equal weightage to survival and growth i.e. average height and average diameter (b h.o.b), rating system was evolved. Twenty marks were assigned for growth i.e. for height and diameter, 10 marks each and in addition 10 marks for survival count. A comparative account of performance on this criteria is indicated in Table 1.

Locality factors of natural zone (FAO, 1979) and those at Dehra Dun were compared to probe into the reasons of varied performance. Due weightage to the important parameters of climate and geographical range, was given while evolving a rating sytem. As it is acknowledged that rainfall type is an important factor, it was given more weightage. Latitude and elevation are the next important parameters and these can be integrated as it is acknowledged that higher elevation corresponds to higher latitudes i.e. rise in elevation by 100 meters corresponds to increase in latitude by 1° (Thirawat 1955). Elevation in the donor zone was correspondingly converted into higher latitudes if natural range of distribution included higher elevations. This parameter was assigned ten marks. Total precipitation, maximum and minimum temperature and frost was assigned ten marks each, giving an aggregate maximum rating of one hundred. Edaphic conditions, though an important factor, are not considered for want of requisite details. Non-comparability on any of these parameters was quantified by assigning marks proportionately and rating for different species is tabulated (Table 2).

Eucalyptus tereticornis had four entries, one each under the name hybrid & 12 ABL and two entries under the name *tereticornis* i.e. one each in both the groups made earlier. It is seen that in the 9th year, these entries have performed more or less on the same footing (Aggregate rating of 29, 22 & 22).

On the basis of aggregate marks (survival and growth), the species are grouped broadly in three categories viz. promising, average and failure as indicated below :

Group I- *Eucalyptus tereticornis*, *melanophola*, *saligna*, (12 ABL, *longifolia*, *hybrid*, *tereticornis*). (*camaldulensis*, *dalrympleana*, *populifolia*, *robusta*).

Group II- *Eucalyptus grandis*, (*leucoxylon*, *citriodora*), (*astringens*, *ficifolia*, *rudis*), *staigeriana* and *sideroxylon*.

Group III- *Eucalyptus botryoides*, *polybractea*, *diversicolor*, *maculata* and *bicostata*.

Table 1

Survival and growth of Eucalyptus introduction in 1975

(Data recorded in January 1984)

Species	Survival (%)	Height (m)	Diameter (b.h o.b.) (cm)	Aggregate rating	Ranking
Eucalyptus astringens	25.00	7.4	6.1	18 (5+7+6)	VIII
E. bicostata		Failure			XV
E. botryoides	19.4	5.4	5.9	15 (4+5+6)	XI
E. camaldulensis	50.0	6.1	5.2	21 (10+6+5)	V
E. citriodora	36.1	6.7	4.9	19 (7+7+5)	VII
E. dalrympleana	41.7	7.8	5.1	21 (8+8+5)	V
E. diversicolor	2.8	6.4	4.5	12 (1+6+5)	XIII
E. ficifolia	30.5	6.6	5.4	18 (6+7+5)	VIII
E. grandis	33.3	7.0	5.7	20 (7+7+6)	VI
E. hybrid	50.0	8.1	3.7	22 (10+8+4)	IV
E. leucoxylon	27.8	6 6	6.0	19 (6+7+6)	VII
E. longifolia	27.8	8.6	6.7	22 (6+9+7)	IV
E. maculata	2.8	3.2	2.2	6 (1+3+2)	XIV
E. melanophloia	63.9	7.8	6.0	27 (13+8+6)	II
E. 12 ABL	38.9	8.0	6.1	22 (8+8+6)	IV
E. tereticornis	55.6	9.6	8.2	29 (11+10+8)	I
E. polybractea	25.0	5.3	3.8	14 (5+5+4)	XII
E. populifolia	16.7	9.5	7.7	21 (3+10+8)	V
E. robusta	30.5	8.1	7.4	21 (6+8+7)	V
E. rudis	33.3	6.6	4.4	18 (7+7+4)	VIII
E. saligna	41.7	8.2	6.5	23 (8+8+7)	III
E. sideroxylon	22.2	6.5	4.7	16 (4+7+5)	X
E. staigeriana	25.0	7.1	5.4	17 (5+7+5)	IX
E. tereticornis	38.9	7.8	5.9	22 (8+8+6)	IV

Table 2

Evaluation of Eucalyptus on the concept of homo-clines

(Conditions at Dehra Dun vis-a-vis natural zone.)

Species	Comparison on parameter of						Total	Rating	Remarks
	Lat+elevation	Rain fall	Precipitation	Temp.		Frost			
				Max,	Min.				
1	2	3	4	5	6	7	8	9	10
Eucalyptus tereticornis	20	30	5	10	10	7.5	82.5	1	
E. melanophloia	20	30	2.5	10	10	10	82.5	1	
E. saligna	20	25	5	7.5	10	7.5	75	2	
E. longifolia	20	15	2.5	7.5	7.5	10	62.5	5	
E. hybrid	20	30	5	10	10	7.5	82.5	1	
E. dalrympleana	20	15	5	7.5	7.5	10	55	8	
E. cemaldulensis	20	20	2.5	10	2.5	2.5	57.5	7	
E. robusta	15	25	5	10	10	5	70	4	
E. populifolia	0	25	0	10	10	7.5	52.5	9	
E. grandis	10	30	7.5	10	7	5	70	4	
E. citriodora	0	30	5	7.5	10	2.5	55	8	

(*Contd...*)

1	2	3	4	5	6	7	8	9	10
E. leucoxylon	20	0	2.5	10	10	5	50.0	10	
E. rudis	15	0	2.5	10	10	5	42.5	12	
E. ficifolia	15	0	5	5	7.5	0	32.5	13	
E. astringens	20	0	0	10	10	5	45.0	11	
E. staigerana	0	30	5	10	0	0	45	11	
E. sideroxylon	20	20	2.5	10	10	0	32.5	3	Wide range of distribution
E. botryoides	20	20	2.5	7.5	10	10	70	4	
E. polybractea	20	15	0	10	10	5	60.5	6	Frost few
E. diversicolor	20	0	5	7.5	7.5	2.5	42.5	12	
E. maculata	20	25	7.5	10	10	0	72.5	3	Not frost tolerance
E. bicostata	20	15	5	7.5	7.5	5	60	6	Wide range of occurrance

Dehra Dun : Lat. 30°28′40″ N., Elevation-640 m.
Rainfall—Summer to uniform type, 2100 mm. Rainy days 80–90.
Frost-15-20 days.
Temp.— Av. max. in summer 30–35°C. Av. min. in winter 3-4°C.

Discussion

It is seen that where the locality factors of donor zone have generally matched, the species have performed well e.g. *Eucalyptus tereticornis*, *melanophloia* and *saligna*. This is in confirmity of the concept of homo-clines. It is further observed that the species from higher latitudes but, lower elevation as compared to Dehra Dun, have also faired well e g. *E. longifolia* and *E. dalrympleana*. This is in confirmity of the hypothesis postulated by earlier workers (Thirawat, 1955, 1956). Species from altogether different climatic and geographical range have failed completely e.g. *polybractea*, *botryoides*; *diversicolor*, *bicostata* & *maculata* have failed, possibly, because of non-comparability on the parameters of rainfall type and the climate. Species from winter rainfall zone have not performed well as predicted by the earlier workers (Thirawat, 1955, 1956; Qureshi, 1967 & FAO, 1979) e.g. *Eucalyptus leucoxylon*, *astringens rudis*, *ficifolia* and *diversicolor*. Better performance due to adaptability to a wider range of climatic conditions by the species having wide range of natural distribution was also noticed. Whereas *E. longifolia* is from winter to uniform rainfall zone *E. populifolia* is from summer to uniform range of rainfall in the natural habitat. These species may thus, have performed well under the Dehra Dun conditions. Despite matching of climatic conditions, poor performance of *E. sideroxylon* may be because of more moist conditions and not so severe summers in the Doon Valley as also because of inappropriate provenance.

Comparison of actual performance with compatibility index can be made. It may please be seen that good compatibility rating index i.e. *tereticornis*, *melanopholia*, *hybrid*, *longifolia* etc. species that have not performed well are comparable with poor rating on compatibility index has shown better performance *i e. E. diversicolor*, *ficifolia*, *populifolia*, *rudis*, *staigeriana*, *leucoxylon* etc. Failure of *maculata* and *polybractea* despite higher comparability index, is possibly on account of frost factor. There are other exceptions and this may be on account of their wide range of natural occurrence i e 26 to 37°, 32–39°, 25–39°, 31–40° respectively for *E. botryoides*, *E. sideroxylon* and *bicostata*. May be if appropriate provenances were introduced, they may have yielded better results. This indicates scope for retrials of some of the tree species that have apparently failed.

In category one, i.e. promising species we have ten species. On the basis of their utility, it is seen that *E. melanophloia* and *E. saligna* have better utilisation than *E. tereticornis*. Though these species occupy position number 2 and 3 in the merit list, as *E saligna* is reported to be a very successful species and with faster rate of growth achieving mean annual increment of 42-50 m^3/ ha/ann, it need be given high priority. It is felt that potential of these species have not so far been tapped. *E. melanophloia* is reported to be a valuable tree species for farm forestry, however, because of its wide range of occurrence, before planting it on commercial scale, provenance testing is necessary (FAO, 1979). *E. populifolia* is indicated for specific edaphic conditions namely black cracking soil and thus, is a potential species for the black cotton soil types obtaining in India.

From the foregoing, it is clear that these species trials have given a wider range of choice for those interested in planting Eucalypts, in the Himalayan Foot-hills of Uttar Pradesh.

SUMMARY

Eucalypts introduction trial at New Forest, which include 24 entries, is reviewed. The species are *Eucalyptus astringens, bicostata, botryoides, camaldulensis, citriodora, dalrympleana, diversicolor, ficifolia, grandis, 'hybrid', leucoxylon, longifolia, maculata, melanophloia, polybractea, populnea, robusta, rudis, sideroxylon, staigeriana, tereticornis* **and** *12 ABL.* **Based on their performance, species have been broadly categorised into three groups namely promising, average and failure. Varied performance of the species is attributed to comparability of locality factors of the donor and the recipient region i.e. Dehra Dun. Important factors contributing to success or failure are identified as comparability on the parameters of latitude, elevation, soil and climatic conditions particularly the temperature regime, frost and rainfall type. Among the species evaluated** *Eucalyptus tereticornis, melanophloia, saligna, longifolia, camaldulensis, dalrympleana, populifolia* **and** *robusta* **are indicated as promising species for the sub Himalayan zone.**

न्यूफॉरेस्ट देहरादून बाहर से लाई युकेलिप्टस जातियों को लगाने के परीक्षणों का मूल्यांकन

एम॰जी॰ गोगटे व यू॰डी॰ ढौंडियाल

सारांश

न्यूफॉरेस्ट में बाहर से लाए युकेलिप्टस लगाने के परीक्षणों की, जिनकी सख्या 24 है, समीक्षा की गई है। इसमें युकेलिप्टस की ये जातियां आई हैं, एस्ट्रिजेंस, बाइकोस्टेटा, बोट्रायडिस, कैमेलड्यूलेंसिस, सायट्रियोडोरा, डेलरिमप्लिआना, डायवर्सिकलर, फायसिफोलिया, ग्रांडिस, हाइब्रिड, ल्यूकोजायलन, लांगीफोलिया, मैक्यूलेटा, मेलानोफिलआ, पोलिब्रैक्टिया, पोपुल्निया, रोबस्टा, र्‍यूडिस, सिडेरोक्सीलन, स्टाईगेरियाना, टेरेटिकार्निस तथा 12 एबीएल। सक्रियता के आधार पर मोटे तौर पर इन जातियों को तीन वर्गों में बांटा गया है अर्थात् उत्साहप्रद औसत और असफल। इन जातियों की भिन्न-भिन्न सक्रियता को प्रदाता और ग्रहीता क्षेत्र अर्थात् देहरादून के स्थल कारकों की समतुलनीयता से सम्बद्ध किया गया है। सफलता या विफलता लाने वाले अक्षांश, ऊंचाई, मृदा और जलवायु दशाएं विशेषकर तापमान स्थितियों वाला और वर्षा का प्रकार समतुलनीस महत्वपूर्ण परिमाप बताए गये हैं। मूल्यांकित जातियों में, युकेलिप्टस टेरेटिकार्निस, मेलानोफिलआ, सेलिग्ना, लॉगीफोलिया, केमेलड्यूलेंसिस, डैलरिमप्लिआना, पोपुलिफोलिया और रोबस्टा उपहिमालीय प्रदेश के उत्साहप्रद बताये गये है।

References

Chaturvedi, A.N. (1983). Eucalypts for farming. *U.P. For. Bulletin* No. 48.

Das, S.S. (1961). Trials with *Eucalyptus* in Orissa : *Proc. Xth Silvi. Conf.* Dehra Dun, 563-569.

FAO (1979). Eucalypts for Planting, *FAO Forestry Papers, Sr. No. 11.*

Ghosh, R.C. (1961) Report on the trial of *Eucalyptus* in West Bengal, *Proc. Silvi. Conf.* 15-20, Nov. 1961, Dehra Dun, 554–559.

Gupta, M (1958) A note on some Australian *Eucalyptus*, their suitability for planting in U P and the results of trials done. *Indian For.*, **84** (10) : 613–616.

Gogate, M G (1984). Eucalypts introduction trialsin U.P. Evaluation and guide lines for future trials, Paper contributed for the *National Seminar on Eucalypts*, Jan. 1984, Peechi.

Iyppu, A I. (1961). Trials with *Eucalyptus*, : *Proc. Xth Silvi. Conf.* Dehra Dun, 560-562.

Kaikini, M.S. (1961). *Eucalyptus* in Mysore State : *Proc. Xth Silvi. Conf.* Dehra Dun, 546-553.

Kamath, P B (1967) *Eucalyptus* in Madhya Pradesh, : *Proc. XIth Silvi. Conf.* 15-25, Dehra Dun, 816–828.

Kaul, R.N. (1965). An approach to provenance trials in relation to tree introduction in Arid lands *Ann. Arid Zone Jodhpur,* 4 (2) : 164-171, 8 ref.

Kaul, R.N. and B.N. Ganguly (1962). Studies on the introduction of *Eucalyptus* in the arid zones of India. *Indian For.*, **88** (5) : 348–355

Kaul, R N. and M.B. Jain, (1967) On the selection of suitable Exotic tree species for Indian arid zone. *Proc. XIVth Congr. Int. Union For.*, *Res. Organ*, Munich, pt. ill, Sect. 22 : 654-671.

Khan, Waheed and N.R. Chaudhary (1961). *Eucalyptus* Trials in India, *Proc. Xth Silvi. Conf.* Dehra Dun, 535–546.

Krishnaswamy, V.S (1957). *Eucalyptus* in Madras State. *VIIth British Commonwealth Forestry Conference*, Australia and New Zealand Madras, Forest Deptt.

Mathur, C.M. (1961). Results of Preliminary trials with *Eucalyptus* sp cies in Rajasthan, *Proc. VIIth Silvi. Conf.* 15-20, Dehra Dun, 570-574

Mathur, R.B. (1973). Eucalypts plantations position paper. *Foresty Conf.* Dehra Dun.

Mathur. R.S. (1983). Editorial, Eucalypts Special I. *Indian For.*, **109** (12).

Pande, D.C. (1961) Plantations of Exotic species–Trials of *Eucalyptus* species in UP : *Proc. Xth Silvi. Conf.* 15-20, Dehra Dun, 610–625.

Qureshi I.M. (1967). *Eucalyptus* for India : *Proc. Silvi. Conf.* Dehra Dun, 638-654.

Sahni, K.C. (1961). A review of the introduction of Exotic forest tress in India : *Proc. Xth Silvi. Conf.* Dehra Dun, 638-654.

Thirawat, S. (1955). The *Eucalyptus* for Tropical Climates. *Indian For.*, **81** (4); 224-247.

Thirawat, S (1956). The value of *Eucalyptus* in Asia. *Indian For.*, **82** (12) : 660-667.

Troup, R.S. (1921). *The Silviculture of Indian Trees.* Vol II.

VEGETATIVE PROPAGATION OF *EUCALYPTUS*

K. GURUMURTI, H.C.S. BHANDARI AND D.S. NEGI

Plant Physiology Branch,
Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

During the last five years, a number of projects have been initiated to improve the yield of wood in forest plants. Among the various plants, *Eucalyptus* is recognised as important for industrial plantations as it provides raw material for pulp and rayon. It is also considered a good species for fuelwood lot as it grows fast, can be closely planted and is not prone to grazing. In these approaches it is essential to maximise the wood yield per unit, area. Additionally attempts to bring about uniformity in stem structure would be of help in mechanising the harvest in industrial plantations. Uniform stem structure would also be of help in successful development of agro-forestry systems. The studies conducted on energy plantations of *Eucalyptus* revealed considerable variation in the population of stand (Gurumurti *et al.*, 1984; Gurumurti and Bhandari, 1987). Multiplication through seeds even when collected from elite trees will continue to maintain heterozygous behaviour. Though with continuous breeding and selection, improvement is possible, the immediate genetic gains may not be much. Also, improvement through sexual means involves several generations. Multiplication of elite trees through vegetative means will improve the yield in shorter span of time. For successful multiplication of clones, high degree of rooting in vegetative material like branch cuttings, leafy cuttings or coppice shoot cuttings is desired. The present paper reports the results obtained on the rooting behaviour of *Eucalyptus* using branch cuttings, leafy cuttings and coppice shoot cuttings.

Meterials and Methods

Branch cutting : 15 mm dia 25 cm long branch cuttings with 2–3 nodes were made from eleven year old elite trees of *Eucalyptus* hybrid, *Eucalyptus* FRI–4 (*Eucalyptus tereticornis* × *Eucalyptus camaldulensis* and *Eucalyptus* FRI–5 (*Eucalyptus camaldulensis* × *Eucalyptus tereticornis*) in the months of June, July, August, September and October and were given 24 hours drip treatment with different concentration of auxins, Indole acetic acid, Indole butyric acid, Napthelene acetic acid and 2,4-Dichlorophenoxy acetic acid and planted in pots filled with soil, sand, farm yard manure (1 : 1 : 1) They were uprooted after 45 days to record rooting data.

Leafy cuttings : Green leaf cuttings of branches from the fresh growth in the above trees were collected and trimmed to retain one pair of leaves and cultured aqueous medium containing different auxins in different combination with and without auxin effectors like potassium metabisulfite and resorcinol for the first 48 hours and subsequently in distilled water. Observations on rooting were recorded after 15 days.

Coppice shoot cuttings : 30 month old *Eucalyptus* hybrid plantations consisting of 600 trees was selected for the purpose. Among these trees, ten per cent of the population showing superior traits in terms of girth and height were identified. Such trees were cut about 8–10 cm above soil level in the last week of February, 1986. The month of February was chosen since spring shoots with vigorous growth was expected to respond to rooting favourably. After eight weeks, large number of coppice sprouts were produced (Plate 1). The sprouts were removed with the pruning shears and placed in a bucket of water to prevent wilting and transported to the laboratory. The shoots were severed into small nodal cuttings, each containing one pair of leaves and the leaf trimmed to one third of original length to reduce the transpiratory loss of water and to avoid overlapping when planted. The bases of the prepared cutting were treated with a fungicide (Emison) for 15 minutes. They were than treated with Indole butyric acid (4000 ppm), diluted with talcum powder, by dusting the lower one cm portion of the cutting. The cuttings were immediately inserted into wetted Vermiculite in the seedling trays (Plate 2). The cuttings in seedling trays were subjected to intermittent mist inside the mist chamber (Plate 3). The misting inside the mist chamber was controlled automatically with electronic leaf (Sharma and Gurumurti, 1986). After 6–7 weeks, the cuttings were removed and rooting data recorded.

Results and Discussion

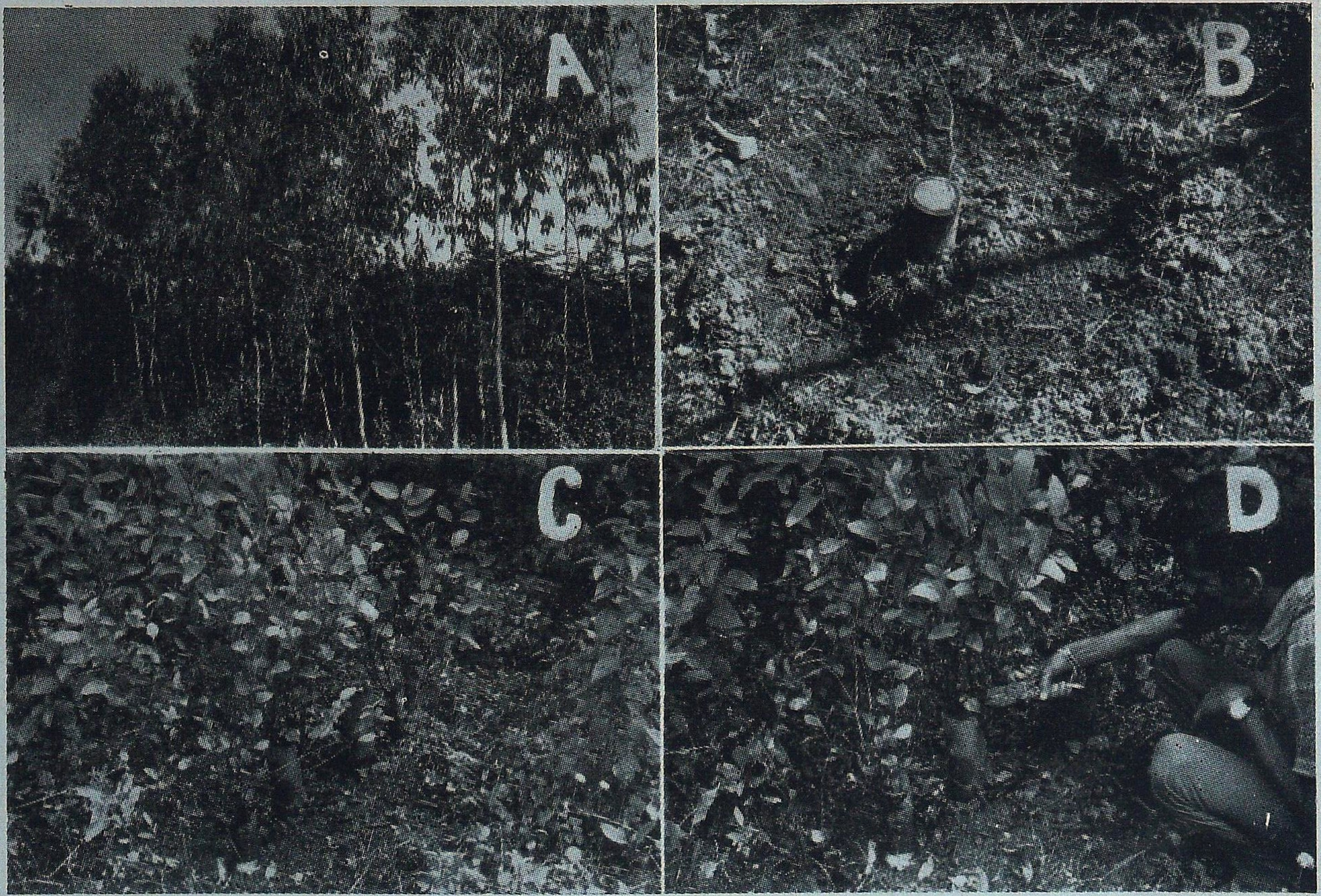
The data on behaviour of branch cuttings of *Eucalyptus* hybrid, *Eucalyptus* FRI-4 and *Eucalyptus* FRI-5 show that sprouting occurred in varying degree in different treatments but none of the cuttings in any of the treatment produced roots (Table 1). In fact, branch cuttings were planted every month beginning June till October at monthly intervals and none of them rooted. Similarly, the leafy cuttings from the mature trees of *Eucalyptus* hybrid cultured in different auxins also completely failed to respond to rooting (Table 2). However, the nodal cuttings made from coppice shoots of 30 month old trees favourably responded to rooting. Almost all the cuttings made from both flowering and non-flowering trees produced callus profusely (Table 3), the per cent rooting response being higher in cuttings made from non-flowering trees compared to flowering trees. Flowering is a prominent characteristic of mature trees. Qualitatively lesser response of rooting in coppice cuttings made from flowering trees compared to those from non-flowering trees and the inability of branch and leafy cuttings taken from older trees to root can thus be attributed to maturation phenomenon. Temporally, as trees age, the differentiation in above-ground parts is restricted to formation of leaves and flower buds. Thus there is repeated activation of selected genes leading to what is termed as mature tissue. Ostensibly, in the mature the tissue, transcription process associated with induction of root initials is suppressed in favour of nucleotide sequences of DNA, amplified for functions of mature tissue This progressive gene repression in mature tissue has been attributed to methylation of chromosomal DNA (Holliday and Pugh, 1975; Hood and Libby, 1978). Thus, when branch and leafy cuttings, from mature tissues are planted, the enormously amplified DNA in them dominates the transcription process and the codes required for root

Table 1

Behaviour of branch cuttings taken from 11 year old trees of Eucalyptus

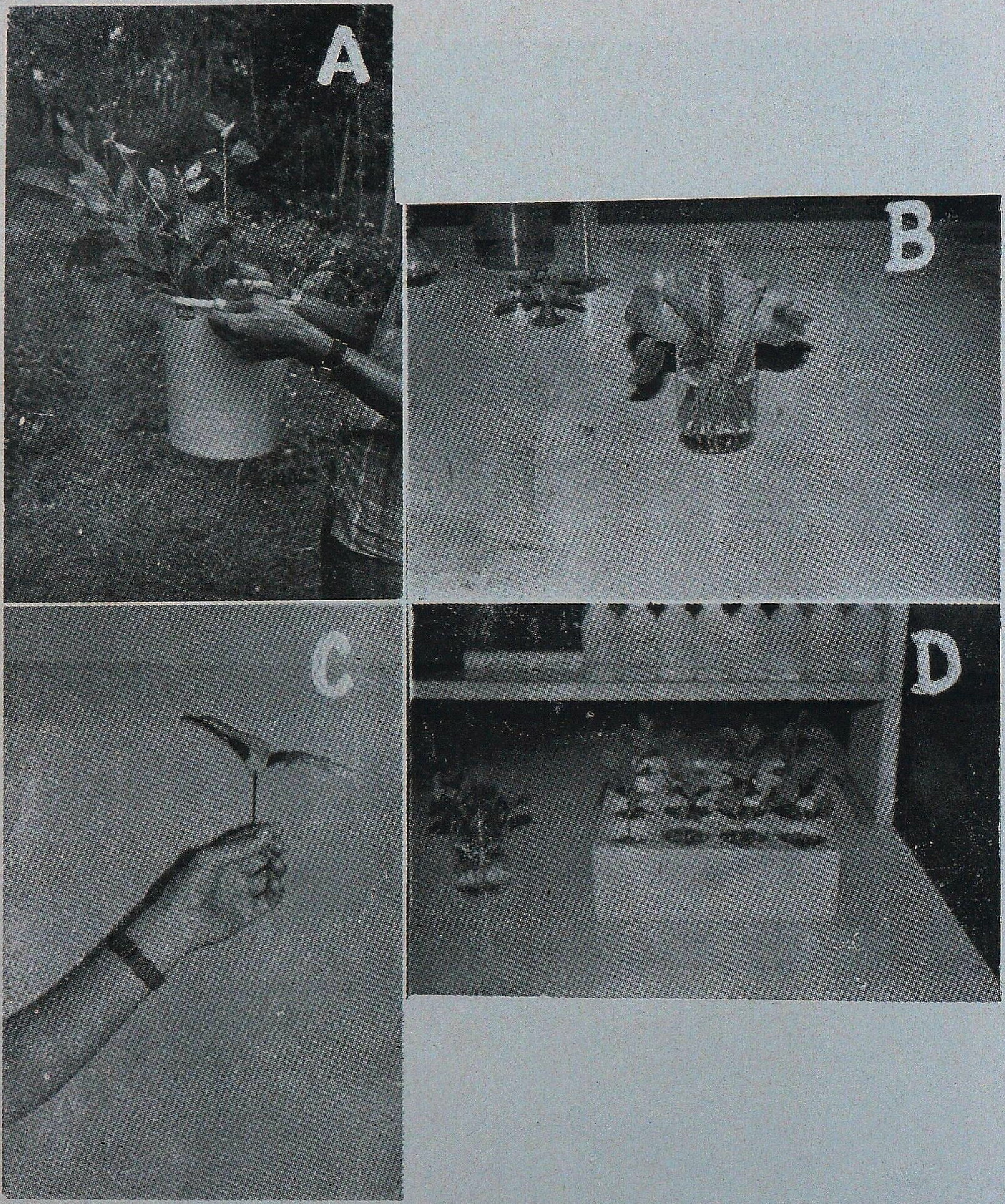
Treatment (ppm)	*Eucalyptus* hybrid			*Eucalyptus* FRI-4			*Eucalyptus* FRI-5		
	No. of cuttings planted	No. of cuttings sprouted	No. of cuttings rooted/ callused	No. of cuttings planted	No. of cuttings sprouted	No. of cuttings rooted/ callused	No of cuttings planted	No of cuttings sprouted	No. of cuttin s rooted/ callused
IBA 100	18	4	0	18	4	0	15	5	0
IBA 50	18	8	0	18	10	0	15	14	0
IAA 100	18	8	0	18	8	0	15	2	0
IAA 50	18	10	0	18	9	0	15	5	0
NAA 100	18	7	0	18	7	0	15	10	0
NAA 50	18	5	0	18	9	0	15	1	0
2,4-D 100	18	0	0	18	6	0	15	4	0
2,4-D 50	18	6	0	18	2	0	15	8	0
Control	18	10	0	18	5	0	15	9	0

Plate 1



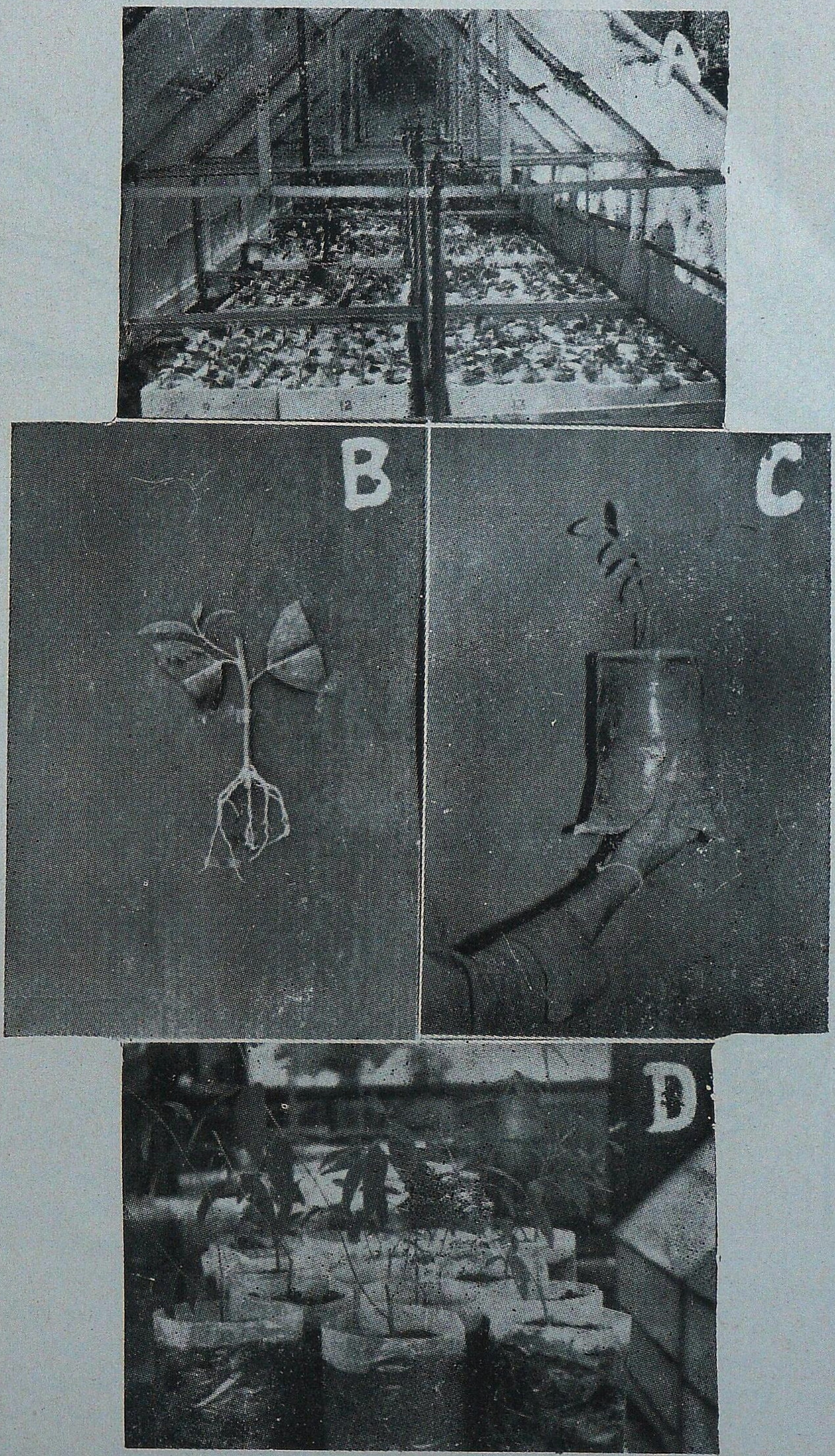
General view of 30 month old plantation (A); cutting off the main stem 8 cm above-ground level B; Juvenile coppice shoots produced at 8 weeks (C) and removal of coppice shoots for preparation of cuttings (D).

Plate 2



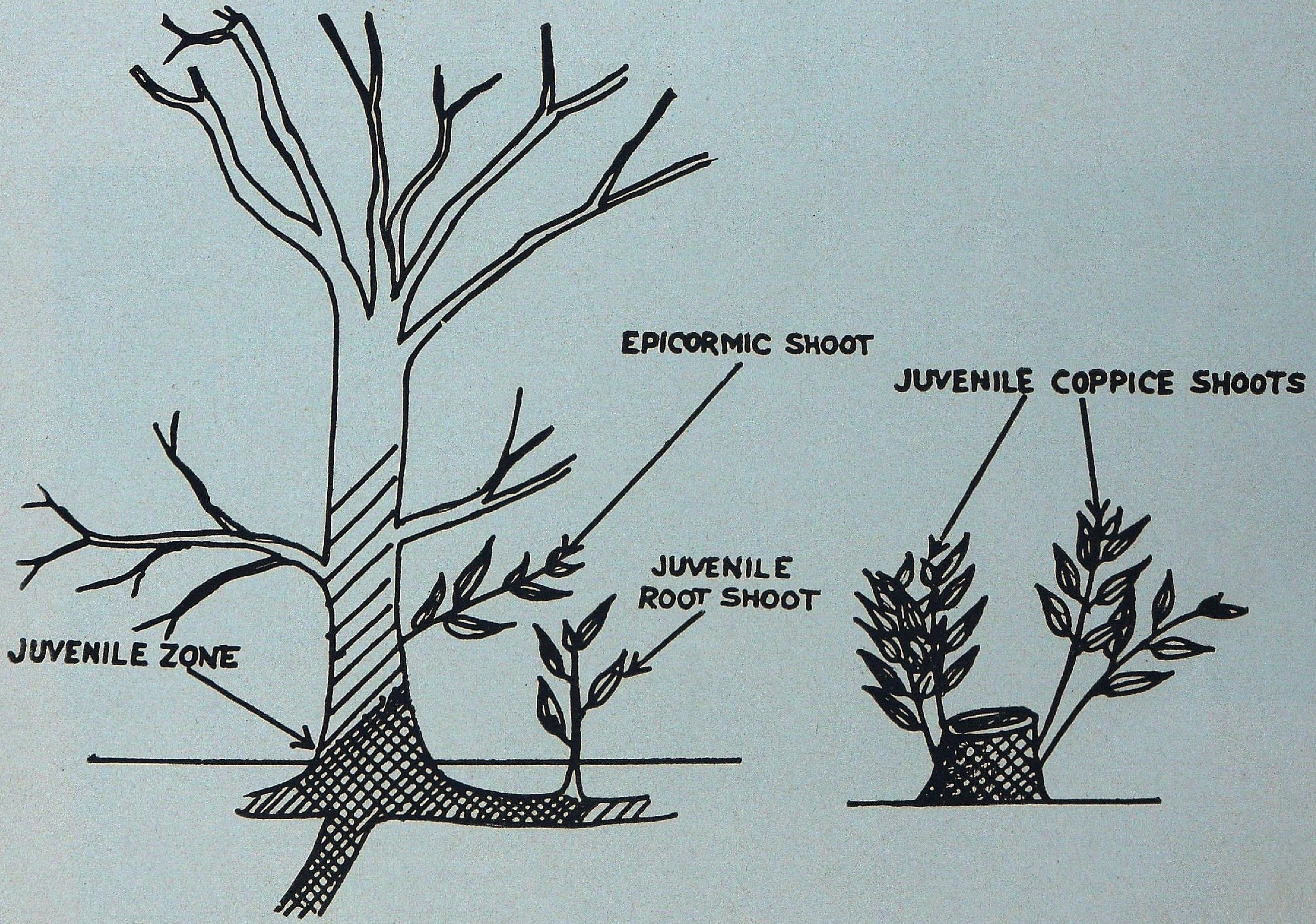
Coppice shoots in a bucket containing water transported to laboratory (A); nodal cuttings prepared for rooting (B); view of the nodal cutting (C) and nodal cuttings treated with IBA planted in vermiculite medium (D).

Plate 3



Nodal cuttings inside the misting unit (A); rooted nodal cuttings (B); rooted nodal cutting planted in polythene bag (C) and hardened cuttings ready for out planting (D).

Plate 4



Juvenility gradients in trees (Bonga, 1982).

Table 2

Behaviour of leafy cuttings from 11 year old trees of Eucalyptus hybrid in aqueous culture containing different auxins.

Culture medium	Number of cuttings planted	Number of cuttings callused/rooted
IAA 5 ppm.	6	—
IAA 10 ppm.	6	—
IBA 5 ppm.	6	—
IBA 10 ppm.	6	—
NAA 5 ppm.	6	—
NAA 10 ppm.	6	—
2,4-D 5 ppm.	6	—
2,4-D 10 ppm.	6	—
IAA 5 ppm + Pot metabisulfite 5 ppm.	6	—
IBA 5 ppm. + Pot. metabisulfite 5 ppm.	6	—
Pot. metabisulfite 5 ppm.	6	—
IAA 5 ppm. + Resorcinol 2 ppm.	6	—
IBA 5 ppm. + Resorcinol 2 ppm	6	—
Resorcinol 2 ppm.	6	—
Control	6	—

initiation and differentiation are not initiated. The above statement implies that maturity of cell meristem in trees is directly proportional to the number of cell divisions that separate the cell or the meristem from the zygote. This may be considered as true since cuttings taken from seedlings root more readily than cuttings taken from older trees (Bachelard and Stowe, 1963; Davidson, 1974; Durand-Cresswell *et al.*, 1982). Alternatively, the cambial initials in the lower part of the trunk having lower rate of activity do not have the need for DNA amplification and hence may have high genetic potential. Thus, when the trees are coppiced, the shoots produced are juvenile which can easily be rooted. This explains the profuse callussing and high percentage of rooting obtained in nodal cuttings made from coppice shoots of *Eucalyptus* hybrid (Table 3). According to Bonga (1982) trees show juvenility gradients with epicormics, stump sprouts and severely pruned trees producing juvenile shoots (Plate 4). Therefore, the coppice shoots produced from mature trees should also show higher potential to root. However, in the present study it was observed that coppice shoots taken from flowering trees were relatively less responsive to rooting compared to those from non-flowering trees. This implies that coppice shoots made from much older trees may show low percentage of rooting. Durand-Cresswell *et al.* (1982) obtained only 8 per cent rooting response in coppice cuttings of *Eucalyptus* made from mature trees. However, when the rooted plants were allowed to grow for two years and coppiced, the rooting in the coppice shoots increased to 60 per cent.

The results presented in this paper show that vegetative material from mature trees show "Obstinancy" to rooting and juvenile tissues root with ease. Using this method it is possible to obtain vegetative propagules on a large scale by developing a clonal garden of elite trees which constitute 5 to 10 per cent of the population. Yield improvement, using such vegetative propagules, to the extent of 64 m^3 ha^{-1} yr^{-1} has been achieved with *Eucalyptus grandis*

on six year rotation in Brazil (Zobel and Ikemori, 1983). Gurumurti and Bhandari (1987) have shown that there is scope to triple the yield of *Eucalyptus* hybrid by multiplication through vegetative propagules.

Table 3

Rooting data of coppice shoot nodal cuttings, prepared from flowering and non-flowering trees treated with IBA – 4000 ppm in talcum powder

GBH range (cm)	Number of cutting planted	Number of cutting callused	Number of cutting rooted	Per cent rooting
A. *Flowering Trees*				
25 – 28	32	29	13	40.6
22 – 25	32	31	11	34.3
19 – 22	32	28	17	53.1
B. *Non-Flowering Trees*				
22 – 25	64	63	37	57.8
19 – 22	32	31	21	65 6
16 – 19	32	32	21	65 6

SUMMARY

Branch and leafy cuttings made from mature trees of *Eucalyptus* completely failed to root whereas the coppice shoot cuttings made from 30 month old trees responded to rooting to the extent of 65 per cent. Probable reasons for inability of mature tissue to root is discussed. A technique to root nodal cuttings prepared from coppice sprouts is presented.

युकेलिप्टस का वर्धी प्रवर्धन

के० गुरूमूर्ति, एच०सी०एस० भण्डारी व डी०सी० नेगी

सारांश

युकेलिप्टस के प्रौढ वृक्षों से ली गई पत्तियोंदार शाखा कलमें लगाए जाने पर जड़ें उत्पन्न करने में पूरी तरह विफल रही परन्तु 30 महीने उम्र के निकले स्थूण प्ररोहों की कलमें लगाने पर उनमें 65% तक में जड़े निकल आईं। प्रौढ ऊतियों में जड़े न निकलने के सभावित कारणों का विवेचन किया गया है। स्थूण प्ररोहों से बनाई पर्वसन्धि-कलमों में जड़े विकसित कराने की प्रविधि भी प्रस्तुत की गई है।

References

Bachelard, E.P. and B.B. Stowe (1963). Rooting of cuttings of *Acer rubrum* L. and *Eucalyptus camaldulensis* Dehn. *Physiol. Plant*. 16 : 20-30.

Bonga, J.M. (1982). Vegetative propagation in relation to juvenility, maturity and rejuvenation *Tissue Culture in Forestry*, J.M. Bonga and D.J. Durzan, Eds. p 150–181. Dr. W. Junk Publishers, The Hague, Boston, London.

Davidson, J. (1974). Grafting *Eucalyptus deglupta*. *New Zealand J. For. Sci.* 4 : 204–210.

Durand-Cresswell, R, M. Boulay and A Franclet (1982). Vegetative propagation of *Eucalyptus*. *Tissue Culture in Forestry*, J.M. Bonga and D J. Durzan, Eds. Dr. W Junk Publishers, The Hague, Boston, London.

Gurumurti, K. and H.C.S. Bhandari (1987). Clonal forestry for high yielding biomass production systems *Proc. National Conf* on *Energy Production* in *Agri.* and *Food Processing*, Punjab Agric. University, Ludhiana. p. 306–321.

Gurumurti, K., M M. Kimothi, D P. Raturi and J.S. Rawat (1984). Biomass production and energy conversion efficiency by *Eucalyptus* in energy plantations. *Indian For.*, **110** (2) : 150-170.

Holliday, R. and J.E. Pugh (1975). DNA modification mechanism and gene activity during development. *Science* 187 : 226–232.

Hood, J V. and W.J Libby (1978). Continuing effects of maturation state in radiata pine and a general maturation model. K W. Hughes, R. Henke, M. Constatin, eds. Propagation of Higher Plants through Tissue culture. *Tech. Inf. Centre, USD Energy Conf.* pp 220–232

Sharma, S.C. and K Gurumurti (1986). Fabrication of electronic device to maintain saturated vapour pressure in mist chamber. *Indian For.*, **112** (11) : 998.

Zobel, B. and Y.K. Ikemori (1983). Vegetative propagation in *Eucalyptus*. *Proc. of* IX *Meeting of the Canadian Tree Improvement Association.* L. Zsuffa, R.M. Rauter and C.W. Yeatman, eds. pp. 136-144.

RELATIVE RESISTANCE OF PINES TO CERCOSEPTORIA NEEDLE BLIGHT IN INDIA

SUJAN SINGH* AND S.N. KHAN**

Forest Research Institute and Colleges, Dehra Dun (India)

Introduction

Cercoseptoria needle blight caused by *Cercoseptoria pini-densiflorae* (Hori et Nambu) Deighton is an important disease of both indigenous and exotic pines in India in nurseries and during initial stages of growth in outplantings. The pathogen is of exotic origin and has been inadvertently introduced into India probably on needle bits which are usually found mixed with pine seeds imported into the country. *Pinus caribaea* Morelet, *P. elliottii* Engelm., *P. oocarpa* Schiede, *P. patula* Schlecht. & Cham., *P. clausa* Vasey, *P. greggii* Engelm., *P. taeda* Linn. and *P. echinata* Mill. among exotic pines and the two indigenous hard pines, *P. roxburghii* Sargent and *P. kesiya* Royle ex Gord. have been found severely attacked by the disease in various nurseries in the States of Uttar Pradesh (U.P.), Andhra Pradesh (A P.), Orissa and Madhya Pradesh (M.P.) (Sujan Singh *et al.*, 1982). The disease manifests in lower needles and slowly spreads upwards. In advanced stages, the needles in the tip only remain green and the diseased needles become dry and curl around the stem. Whenever Cercoseptoria needle blight was recorded in plantations, the source of infection could invariably be traced to diseased seedlings used as planting stock for raising plantations in different States. Observations taken in plantations in different States to determine relative field resistance of different hard pines to Cercoseptoria needle blight form the subject of this publication. A brief summary of temperature and rain fall of the areas where the plantations had been raised is given in appendix-1.

Pinus caribaea var. *caribaea* : *P. caribaea* suffered heavy losses during first two years of their growth in plantations at Jagdalpur and Jamgaon (M P.), Koraput (Orissa), Araku (A P.) and New Forest (U.P.). More than 50 per cent of plants died during the first year. The replacements also suffered the same fate as seedlings for replacement were also obtained from infected nurseries. From the third year onwards, the surviving plants in M.P., Orissa and A.P. States overcame the attack of the disease and grew healthy notwithstanding existance of a few infected needles on the basal portions of the trees. In New Forest, however, the infection continued on needles in the outer portion of the lower crown up to seven years of age without having any apparent ill-effect on the health of the plants.

In a small plantation of *P. caribaea* var. *bahamensis* in Dehra Dun East Forest

---

* Officer-in-Charge, Forest Pathology Branch. ** Scientist-2, Disease Insect Survey.

Division (U.P.), the attack of *C. pini-densiflorae* continued to adversely affect the growth of infected plants even up to five years age. The diseased plants showed stunted growth. A few plants succumbed to the disease.

Pinus patula : *P. patula* raised extensively in Kumaon Hills, (U.P.) between altitudes of 1200-1800 m developed resistance to Cercoseptoria needle disease during the first year of field plantings. Even badly infected nursery seedlings recovered from the disease. At lower altitudes (550–700 m) in small plantations in New Forest, Dehra Dun (20-year old), and Kalsi, Chakrata Forest Division (7-year old), both in U.P., *P. patula*, however, continued to be attacked by Cercoseptoria needle blight even up to 20 years age The fungus mostly attacked the needles in the outer lower crown. The disease manifests every year during September immediately after rains and by December, the diseased trees appear fire scorched in the outer portions of the lower crown.

Pinus kesiya : *P. kesiya* suffered heavily from Cercoseptoria needle blight during first year of its planting in the field when nursery infected seedlings were used as planting stock. In Araku (A.P.), more than 50 per cent of plants died five months after planting. The surviving plants, however, overcame the infection during second year when infected needles of the previous year were found at the lower portion of the stem while the new growth remained free from fungal attack. The plants grew completely free from disease during subsequent years.

Pinus roxburghii : *P. roxburghii* suffered heavily from Cercoseptoria needle blight in nurseries as well as in plantations. There was heavy mortality during first year of planting in the field when nursery infected seedlings were used as planting stock. During subsequent years, the pathogen continued to spread further on new growths with the result that even in 5–6 year old plantations, only the terminal portions of the plants bore green, healthy needles while more than 3/4th of the main stem and branches were covered with dried needles badly infected by *C. pini-densiflorae*. In a 9-year old plantation in Daringbadi (Orissa), all the surviving plants were stunted and bushy in growth with no clearly emerging main shoot, with green needles only on terminal portions of the branches and with lower stem portions clothed with dead infected needles.

A plantation of *P. roxburghii* in Kalsi (Chakrata Forest Division, U.P.) raised from disease free nursery stock grew free from Cercoseptoria needle blight for nine years when gaps were planted with nursery infected seedlings of *P. roxburghii* and *P. greggii*. Observations taken three years after replacements indicated that *P. greggi* replacements had mostly recovered from the disease but *P. roxburghii* replacements not only continued to be badly infected by the disease but from these plants the older plants (12-years old at that time) had also been infected in outer portions of their lower crown.

Small scale plantations of *P. patula*, *P. pseudostrobus*, *P. elliottii* and many other exotic pines in Pithoragarh Forest Division, (U.P.) had been raised from nursery infected seedlings after clearfelling *P. roxburghii*

forest. It was obsevred that all exotic pine plants recovered from the disease while naturally regenerating *P. roxburghii* got heavily infected by Cercoseptoria needle blight resulting in sporadic mortality of affected plants

Pinus oocarpa : *P. oocarpa* was heavily infected by Cercoseptoria needle blight in nurseries as well as in plantations More than 50 per cent mortality in a small plantation in Araku (A.P) was observed within five months after planting. Seedlings infected in the nursery had been used for raising this plantation. Spread of Cercoseptoria needle blight continued further in this plantation upto third year also In Koraput (Orissa), a 6-year old plantation of *P. oocarpa* was found heavily infected by Cercoseptoria needle blight. Infected plants showed stunted growth and appeared as if burnt by fire in outer crown. Heavily infected plants succumbed to the disease.

Pinus radiata : Younger plantations of *Pinus radiata* were not available for recording observations on resistance of this species to Cercoseptoria needle blight. The disease was, however, very servere on this species on 47 plants (12-year old) in Mahesh Khan (U.P.) and 7 plants (15 year old) in Araku (A.P.). In both cases, *P. radiata* plants had been raised in diseased nursery site. The affected plants bore scanty needles, showed stunted growth and were almost on the verge of dying.

Pinus elliottii : *P. elliottii* was found to resist the attack of Cercoseptoria needle blight even in nurseries. All plants of this species were found free from the disease in 2-month old plantations in Sasola, Dharm Garh and Brahm Sarovar plantations in Kumaon Hills (U P.) though the plantations had been raised from seedlings taken from infected nurseries. In a small plantation in Kalsi (U.P.), however, Cercoseptoria needle blight continued to persist on *P. elliottii* up to two years after planting. The disease was, however, not found on these plants after two years age.

Pinus greggii : *P. greggii* was found to resist the attack of Cercoseptoria needle blight within 6-months after planting of nursery infected seedlings. Nursery infected seedlings were found to completely recover from the disease within one year of their planting in the field in Kumaon Hills (U.P). In a small plantation at Kalsi (U.P.), however, Cercoseptoria needle blight continued to spread upto two years after which the disease spread was almost negligible.

Pinus pseudostrobus : *P. pseudostrobus* was found to completly recover from Cercoseptoria needle blight within one year of their planting in the field in Kumaon Hills (altitude 1600-1800 m) in U.P In a small plantation in New Forest, however (altitude 640 m), Cercoseptoria needle blight continued to spread even upto four years of plantation age. The disease affected the needles only in outer portion of the crown.

Pinus clausa : *P clausa* was found heavily infected in nurseries at Lohaghat and Kalika (U.P). Many of these nursery infected plants died within 4-5 months of their planting in the field. At two years age, all the surviving plants had, however, completely recovered from the disease.

Based on field observations on performance of different pine species in

plantations against Cercoseptoria needle blight an attempt is made to categorise pine species in following three groups.

1. *Susceptible* : Affected plants stunted, generally becoming bushy, main stem/branches covered with needles killed by *C. pini-densiflorae* excepting growing tips. Affected trees may be killed in advanced stages of disease. *Pinus radiata*, *P. roxburghii*. *P. oocarpa*, *P. caribaea* var. *bahamensis* belong to this category.

2. *Moderately resistant* : Infection on needles of lower branches heavy during first two years after which needles in outer crown only attacked giving affected trees a fire burnt appearance. No apparent ill effect on growth of trees. *Pinus caribaea* var. *caribaea*, *P. greggii*, *P. pseudostrobus*, *P patula* (when raised out side their temperature ranges) belong to this category.

3. *Resistant* : Needles on lower branches attacked during first 1-2 years after which infection rarely spreads further. Old attack of disease, if any, confined to a few needles at basal portions of the stem. *Pinus kesiya*, *P. elliottii*, *P clausa* and also *P. caribaea* var *caribaea*, *P greggii*, *P. pseudostrobus* and *P. patula* when raised in their natural temperature zones belong to this category.

Appendix 1

Environmental conditions of areas where some hard pine plantations are being raised in India.

Locality	Environmental Conditions					
	Mean Annual Temperature (C)	Mean Maximum Temperature (Hottest month) (C)	Mean Minimum Temperature (Coldest month) (C)	Annual rainfall (mm)	Altitude (m)	Latitude (N)
Uttar Pradesh						
Dehra Dun	21.6	35 6	6.7	2160	640	30°20'
Ranikhat	15.6	25 6	5.6	13000	1750	29°40'
Kalsi*	25.7*	35.5*	5.0*	1328*	570	30°19'
Madhyu Pradesh						
Jagdalpur	24.6	38.6	9.8	1607	500	19°05'
Orissa						
Koraput	22.7	35.5	9.7	1597	851	18°52'
Daringbadi	—	31.0	1.0	17 0	945	20°0' (app)
Andhra Pradesh						
Araku	—	32.0	6 0	1100	1100	18°50' (app)

*Figures given are for the year 1980 only.

SUMMARY

The paper deals with field resistance of different hard pines being raised in plantations in India against Cercoseptoria needle blight disease. Based on field observations, *Pinus radiata*, *P. roxburghii*, *P. oocarpa* and *P. caribaea* var. *bahamensis* are categorized as susceptible to the disease. *P. caribaea* var. *caribaea*, *P. greggii*, *P. pseudostrobus* and *P. patula* are categorized as moderately resistant in plantations which are raised out side their natural temperature zones but resistant in plantations raised in their natural temperature zones. *P. kesiya*, *P. elliottii* and *P. clausa* are found resistant to the disease.

भारत में सेर्कोसेप्टोरिया पर्ण महारोग के प्रति चीड़ों की सापेक्षिक प्रतिरोधक्षमता

सुजान सिंह ब एस०एन० खान

सारांश

प्रस्तुत अभिपत्र भारत के रोपवनों में लगाए जा रहे विभिन्न कठोर चीड़ों की सेर्कोसेप्टोरिया पर्ण महारोग के प्रति क्षेत्र प्रतिरोधिता से सम्बन्धित है। क्षेत्र प्रर्यावलोकनों के आधार पर पाइनस रेडियाटा, पा० राक्सवर्धीआई, पा० ऊकार्पा और पा० केरिबिया विभेद बहामेंसिस को इस रोग के प्रति प्रभावग्राही बताया गया है। पा० कैरिबिया विभेद कैरिबिया, पा० ग्रेगिआई, पा० स्युडोस्ट्रोबुस और पा० पैटुला को अपने स्वाभाविक तापमान क्षेत्र से बाहर लगे रोपवनों में मध्यम प्रतिरोधी बताया गया परन्तु अपने स्वाभाविक तापमान क्षेत्रों में उगाए रोपवनों में ये प्रतिरोधी हैं। पा० केसिया, पा० इलियटिआई और पा० क्लासा इस रोग के प्रतिरोधी पाए गये।

Reference

Singh Sujan, S.N. Khan, B.M. Misra and Kamla Uniyal (1982). Some important diseases of hard pines in India. *Indian For.*, **108** (1) : 86–92.

———

AN INTERESTING CASE OF EPIPHYTISM OF *EUPHORBIA NERIIFOLIA* LINN. FROM GUJARAT

K.V. BILLORE

Regional Research Institute (Ayurveda), Jaipur (Rajasthan)

Introduction

Euphorbia neriifolia Linn. is one of the well known and widely distributed prickly succulents of the family Euphorbiaceae. It is a large, much branched succulent shrub or small tree, often with semi-circular and oval canopy and the plant-spread reaching ± 6.5 m in height and 10 m in diameter. It is known to grow terrestrially, in exposed rocky terrains throughout the Deccan Peninsula, extending almost up to the northern extremity of the Aravallis and also in a few other states (Dazell & Gibson (1861), Hooker (1890), Cooke (1908), Talbot (1909), Santapau 1962), Chavan & Oza (1966), Patel (1971) and Shah (1979). However, during a botanical excursion in April, 1979 in the forest near Idar, Sabarkantha District in the vicinity of Sarneshwar one robust plant of *Euphorbia neriifolia* Linn. was observed to be growing on the trunk of *Aegle marmelos* (L.) Corr., exhibiting an interesting case of epiphytism of *Eurphorbia neriifolia* Linn. hitherto unrecorded so far (Fig. 1). A similar case, with *Anogeissus latifolia* Bedd. as host and *Euphorbia royleana* Boiss. as epiphyte, has been recorded by Bir & Sharma (1980) from Nahan area, Himachal Pradesh. Such cases of epiphytism of large shrubs on tree trunks are rather rare in nature.

The host tree *Aegle marmelos* (L.) Corr., a medium sized tall tree over 10 m high, ± 45 cm in girth and practically leafless, was growing in the forest outskirt along the road between Sarneshwar and Abhapur Polo Reserve Forest. The forest composition is chiefly deciduous, consisting of *Tectona grandis*. *Butea monosperma*, *Miliusa tomentosa*, *Terminalia bellerica*, *Mitragyna parviflora*, *Holoptelea integrifolia* along with *Putranjiva roxbughii*, *Strychnos potatorum*, *Alangium salvifolium* etc.

Fig. 1

Euphorbia neriifolia Linn. is common in the exposed rocky areas, characterised by its terete branches with 5 more or less spirally twisted ribs; involucres brick-red or pale-yellow in solitary or twin cymes; fruits pale or reddish. It is also cultivated along fields etc. The epiphytic plant was growing on the accumulated humus in the hollow of the bifurcating trunk of the host tree, a little over one metre from the ground (see Fig. 1 indicated by a stick). The luxuriant growth (Reaching $2\frac{1}{2}$ m high), with profuse branching, flowering and fruiting of the plant, indicates that the plant has successfully adapted itself to the present epiphytic mode of life. It is also worth noting that the development of the host tree is unaltered and not affected in any way by the epiphytic growth of such a large shrub.

Acknowledgements

My grateful thanks are due to the Director, CCRAS, New Delhi and the Assistant Director Incharge, Regional Research.Institute of Ayurveda, Jaipur, for the encouragement and facilities provided.

SUMMARY

An interesting record of *Euphorbia neriifolia* Linn. growing epiphytically on *Aegle marmelos* (L.) Corr., hitherto unreported has beed presnted.

गुजरात से युफोर्बिया पेरिआईफोलिया लिन० की पररोहिता का रोचक वृत

के०वी० बिल्लोरे

सारांश

ईग्ले मार्मेलोस (लिन०) कोर्र पर पररोही उग रहे युफोबिया पेरिआईफोलिया लिन०, जैसा अब तक कहीं सूचित नहीं हुआ, का रोचक वृत दिया गया है।

References

Anon. (1952). *The wealth of India* (Raw materials) III : 226.

Anon (1979). *Newsletter*—Central Council for Research in Ayurveda and Siddha, New Delhi 2 (4) : 2.

Bir, S.S. and M. Sharma (1980). *Euphorbia royleana* Boiss. an epiphyte on *Anogeissus latifolia* (Roxb.) Wall. ex. Bedd. *Indian For.*, **106** (10) : 744.

Cooke, T. (1908). *The flora of the Presidency of Bombay*. 3 : 563.

Chavan, A.R. & G M. Oza (1966). *The flora of Pavagadh, Baroda.*

Dazell, N. A. and A. Gibson (1861). *The Bombay flora.*

Hooker, J.D. (1890). *The flora of British India* 5 : 255.

Patel, R.I. (1971). *Forest floro of Gujarat State* Baroda, 248.

Santapau, H. (1962). *The flora of Saurashtra*, Pt. 1. Rajkot.

Shah, G L. (1979). *Flora of Gujarat*. Vol. II.

Talbot, W.A. (1909). *Forest flora of Bombay Presidency and Sindh*-2 : 432

———

OBSERVATION ON SPIDER PREDATION ON TERMITE'S ALATES

SUSHIL KUMAR

Forest Entomology Branch,
Forest Research Institute and Colleges, Dehra Dun (India)

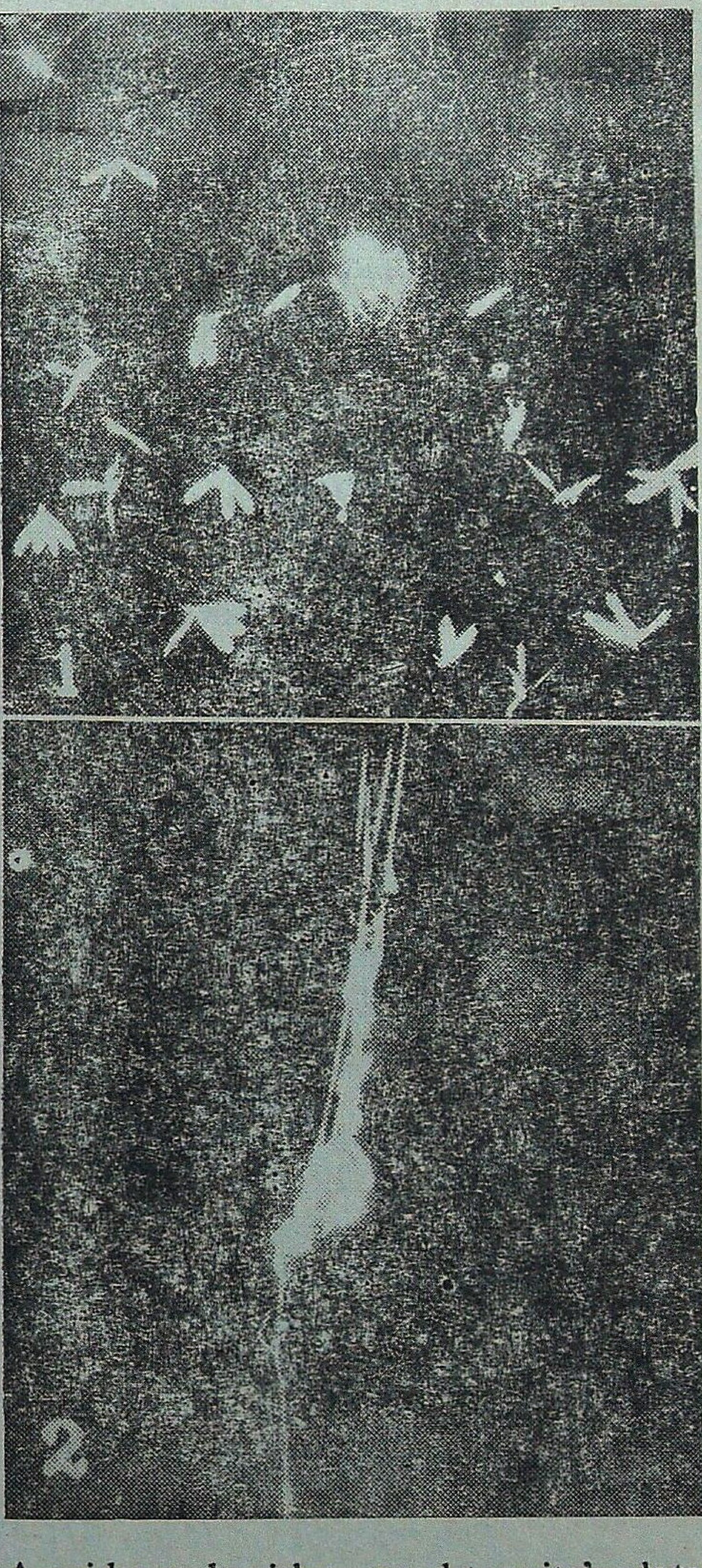
Introduction

Termites live in hidden places and therefore remain secured from their foes. However, during foraging, swarming and other activities, they serve as food of a wide variety of animals both chordate and non-chordate. Mathur (1960) has given an account of enemies of termites in India but has not mentioned predation of termites by spiders. He catagorised the ants as the worst enemies. Sheppe (1970) reported *Geoplanid turbellerians* trapping termites in secreted slime and feeding on them. Sen-Sarma (1974) has mentioned the predation of termite alates by dragonflies, frogs, toads and bats, etc. in India. The reduviid *Salyvata variegata* uses a bait-and-capture strategy of predation that appears to be so uniquely adapted to preying on *Nasutitermes* species that it exclusively feeds on termites (McMahan, 1982), Goodall (1964) recorded the use of small twigs and stems by Chimpanzees to extract the termites (*Macrotermes bellicosus*) from their mounds at Gomba stream reserve in Tanzania. McMahan (1986) has reviewed the available information of termites predation by non-chordates and chordates.

Observations

Among non-chordates, spider is a unique animal which builds webs to serve as a trap for the prey. The author encountered a few instances of predation by a web forming spider on the swarming alates of

Figs 1 and 2



1. A spider web with trapped termite's alates.
2. A rolled web with entangled alates.

termite species, *Microtermes unicolor* Snyder during the month of June at Jabalpur (Madhya Pradesh) where this species has been recorded to swarm late in the evening between 7.30–8.30 PM. Simultaneously a spider was found building web in a Varanda where one 60 watt bulb was on. During the swarm, the alates were attracted to light and got trapped in spider web (Fig. 1a) and creating vibrations in the web in their efforts to extricate themselves from the trap. The alerted spider then injured the alates by its mouth and legs as to make them immobile. In this way a good number of alates were seen trapped by the time the swarming stopped. At about 8.30 to 9.30 PM, the spider rolled the web along with entangled alates and dragged the roll to a hiding place in the roof (Fig. 2).

This prey capturing strategy was observed for three days at the same place by the same type of spider. Apparently it seems that web formation by spider coincided with the swarming of the termite species. So, predation of alates during swarming, the spider seems to play an important role as a potential biological control agent.

Acknowledgement

The author is grateful to Dr. P.K. Sen-Sarma, Director Biological Research, FRI, Dehra Dun for suggestions and going through the paper.

SUMMARY

In this article, the author has described the predation of termite's alates of *Microtermes unicolor* **Snyder by spiders.**

सपक्ष दीमकों पर मकड़ियों की हिंस्रता का पर्यवलोकन

सुशील कुमार

सारांश

इस अभिपत्र में लेखक ने जाला बनाने वाली मकड़ी द्वारा झुण्ड बनाती सपक्ष दीमक जाति, माइक्रोटर्मिस युनिकलर स्नाइडर को मार खाने का वर्णन किया है।

Refrences

Goodall, J. (1964). Tool-using and aimed throwing in a community of free-living chimpanzees. *Nature*, 201 : 1264-1266.

Mathur, R.N. (1962). Enemies of termites (White-ants). *Termites of the Humid Tropics. Proc. Symp. New Delhi, UNESCO*, Paris : 137-139.

McMahan, E.A. (1982). Bait-and-capture strategy of a termite eating assasin bug. *Insect Soc.*, **29** : 346-351

.... (1986) Beneficial aspects of termites. *Economic impact and control of social insects* (Ed. S.B. Vinson), Praeger publishers, New York : 144-164

Sen Sarma-P.K. (1974). Ecology and biogeography of the termites of India. *Ecology and Biogeography in India.* 471-472 (M.S. Mani Ed), Junk. The Hague

Sheppe, W. (1970). Invertebrate predation of termites of the African Savanna. *Insects Soc.*, **17** : 205-218.

- — — — -

FIRST RECORD OF *MIMOSA PUDICA* LINN. AS HOST OF *KUSMI* LAC. *KERRIA LACCA* (KERR.) FROM NAMKUM, RANCHI

B.N. SAH AND R.D. PATHAK

Indian Lac Research Institute, Namkum, Ranchi (Bihar)

Introduction

About 192 host plants were recorded by Roonwal (1958) in India and around places. Some more host plants were recorded in India by other workers But the *Mimosa pudica* Linn. (Vern.-*Lajwanti*) (Leguminosae : Mimosidae) a diffuse under shrub, 50-90 cm high, native of tropical America, naturalized nearly throughout the tropical and sub-tropical parts of India has never been reported to be lac host earlier. It is common in waste ground, particularly where the climate is warm and moist and exceedingly sensitive to touch It has versatile use as cattle feed, production of coating materials and also medicinal use.

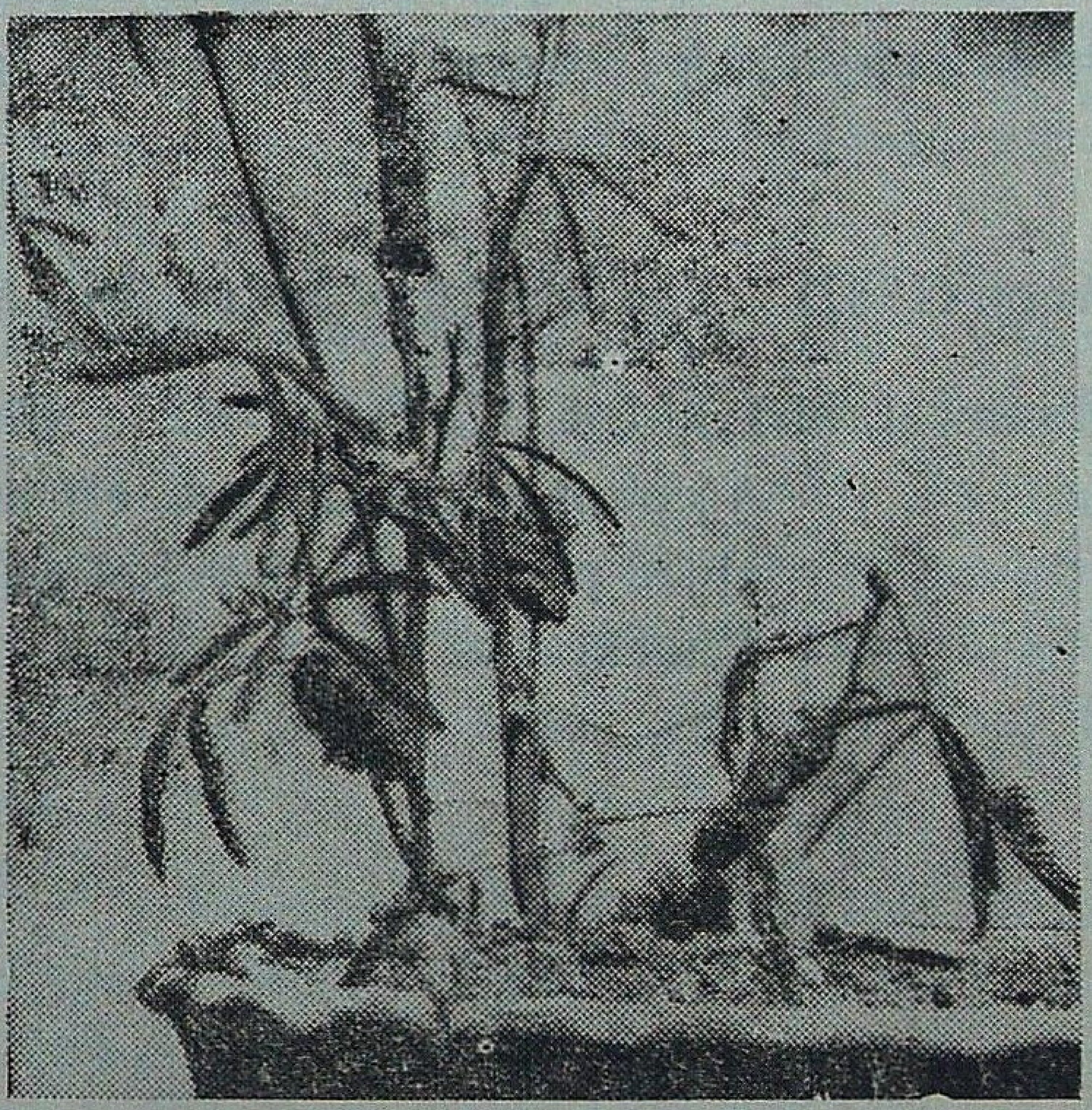
Observations

While supervising harvesting operation of *aghani* crop on *kusum* (*Schleichera oleosa* (Lour.) Oken.) in the Institute plantation at Namkum, Ranchi, the authors came across this new lac host bearing healthy natural lac encrustation. This host plant was got identified as *Mimosa pudica* Linn. These plants were present between open space of rows of *kusum* trees, obviously the source of inoculation was the brood lac bundles fallen from the *kusum* trees during July, 1980.

Other species of the genus *Mimosa* i.e. *M. cineria* from Burma, *M corinda* from India and *M. serissa* in Sind as lac host have been reported by Roonwal *et al.* (1958).

To confirm the suitability of this plant as regular lac hosts, inoculation on the new host plants were done in potted plants as well as in the field continuously for three years from 1981 to 1983 which showed that *oghani* crop could be raised successfully. The development of cells at all the stages was similar to *kusum* (Fig. 1). Raising of *katki* crop was also tried. It was observed that larval settlement was as good as that of *kusum*, cells developed at the sex differentiation stage, after which they died. About 25

Fig. 1



Mimosa pudica Linn. bearing lac encrustation during *aghani* crop.

gms lac per plant was available. Trials were also made to raise *baisakhi* and *jethwi* crop on this host but no crop was obtained since the host plant dried up in summer.

Besides *bhalia* (*Moghania macrophylla* (Willd.) O. Ktze. this under shrub is a good finding for raising *kusmi* lac on this bushy host plant as it is naturally found in waste land. This host may be quite useful for maintaining laboratory cultures required for various entomological experiments.

Further study is required to find out the economics and possibility of commercial lac cultivation on this host plant.

Acknowledgement

Sincere thanks are due to Shri B.B. Das, Head, Division of Entomology for going through the manuscript and giving valuable suggestions and also to the Director, Botanical Survey of India, Calcutta for identifying the plant.

SUMMARY

In this paper, *Mimosa pudica* Linn. is reported for the first time as *kusmi* lac host from Namkum, Ranchi. *Aghani* crops could be raised successfully on it.

नामकुम, रांची से कुसुमी लाख केरिया लाक्का (केर०) के पोषी रूप में
माइमोसा प्यूडिका लि० का प्रथमोल्लेख

बी०एन० साहू व आर०डी० पाठक

सारांश

इस अभिपत्र में कुसुमी लाख पोषी के रूप में नामकुम, रांची से माइमोसा प्यूडिका लि० को पहली बार सूचित किया गया है। इस पर अगहनी फसल बनाना सफल रहा।

References

Anon (1962). The Wealth of India, Raw Materials. Vol. VI : L-M. p. 382.

Roonwal, M.L., M.B. Raizada, R.N. Chatterji and Balwant Singh (1958). Descriptive Account of the Host-plants of the Lac insect, *Laccifer lacca* (Kerr) and the allied plants in the Indian Region. Part 1 and 2 Indian Lac Committee, Ranchi. 140 pp.

ZEUXINE CLANDESTINA BL. (ORCHIDACEAE)—A NEW RECORD TO INDIA

A. NAGESWARA RAO

Orchid Research and Development Centre, Tipi, Bhalukpong (Arunachal Pradesh)

Introduction

The genus *Zeuxine* Lindl. (Orchidaceae is represented by about 12 species in India. During a revisionary study of the genus under National Flora Project of Botanical Survey of India, one of the specimens received from Madras Herbarium collected by E. Vajravelu from Kerala in 1979, upon a critical study proved to be *Zeuxine clandestina* Bl. which is so far known only from Thailand, Malaya and Java and hence is reported here as a new addition to the orchid flora of India.

Although, Smith (1905) had expressed his opinion to consider *Z. clandestina* as a form of *Z. gracilis* (Breda) Bl. which is subsequent workers like Holttum (1957), Backer & Bakhuisen (1968), Seidenfaden (1978) considered these two species as distinct entities by giving some good separating characters.

The present comparative study based on the herbarium specimens of *Z. clandestina* and its allied species *Z. gracilis* has further corroborated the opinion of above workers to treat them as two separate species

Zeuxine clandestina can be distinguished from the allied *Z. gracilis* by the following characters shown in the key.

Leaves 2-4, ovate, the largest 3.5 × 2.0 cm. Inflorescence including rachis upto 18 cm. Petals 1-nerved, gradually narrowed at base. Epichile of lip 2.5 mm across when spread out. Papillae in the sac of lip pointed at apex...... *Z. clandestina*

Leaves upto 8, lanceolate, the largest 7.0 × 2.5 cm. Inflorescence including rachis upto 27 cm. Petals 2-nerved, abruptly narrowed at base. Epichile of lip 3.5 mm across when spread out. Papillae in the sac of lip obtuse at tip... ....*Z. gracilis*

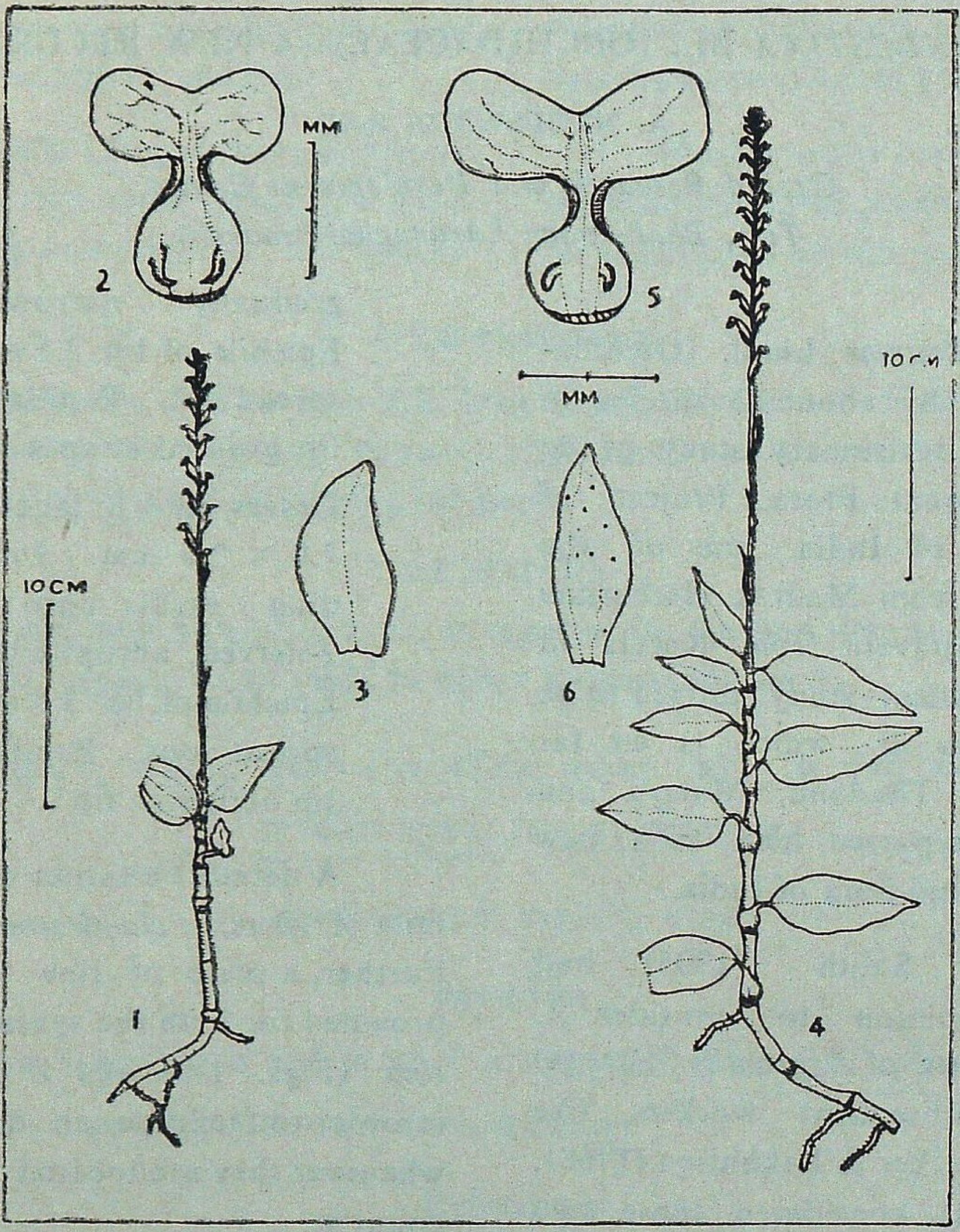
A detailed citation with a distribution note of *Zeuxine clandestina* is given below. Further, a plate of line drawings is also provided for both the species viz. *Z. clandestina* (Figs. 1-3) and *Z. gracilis* (Figs. 4-6) in order to facilitate an easy identification whenever they are located elsewhere in the country.

Zeuxine clandestina Bl. Coll. Orch. Arch Ind. 70. T. 39. fig. 4. 1858; J.J Sm. in Fl. Buit. 6 : 111. fig. 79. 1905; Holttum, Fl. Malaya 1 : 135. fig. 21 1957; Backer & Bakhuisen in Fl. Java 3 : 270. 1968; Seidenf. in Dans. Bot. Arkiv 32 (2) : 87. fig. 54. 1978.

Specimen examined : Kerala, Palghat district, Silent Valley R F., Estate way, 1100 m. *E. Vajravelu* 59101, MH (wrongly identified as *Z. gracilis*).

Distribution : India (Kerala), Thailand, Malaya and Java.

Figs. 1—6



Figs. 1-3 : *Zeuxine clandestina* Bl. 1. Plant, 2. Lip, 3. Petal (*Vajravelu* 59101, MH).
Figs. 4-6 : *Z. gracilis* (Breda) Bl. 4. Plant, 5. Lip, 6. Petal (*Chandrabose* 54214, MH).

Acknowledgements

Sincere thanks are due to Shri S.B. Roy, Chief Conservator of Forests, Itanagar, Shri G S. Thapliyal, Conservator of Forests, Banderdewa and Dr. S.N. Hegde, Orchidologist, Tipi, Forest Department of Arunachal Pradesh for facilities and encouragement and to the Director, Botanical Survey of India, Howrah for allotting to me the revisionary study of Neottic Orchids under National Flora Project.

SUMMARY

In this paper *Zeuxine clandestina* Bl. is reported from Kerala as a new addition to the orchid flora of India.

जायक्सिने कलैण्डेस्टाइना ब्लू० (पीनशिफ कुल) – भारत से नया उल्लेख

ए० नागेश्वर राव

सारांश

इस अभिपत्र में केरल से जायक्सिने कलैण्डेस्टाइना ब्लू० को मिलता सूचित किया गया है, जो भारत के पीनशिफ पेड़-पौधों में एक नयी नाम वृद्धि है।

References

Backer, C.A. & R.C. Bakhuisen (1958). Orchidaceae : *Flora of Java* 3 : 215-451. Groningen.

Holttum, R E. (1957). Orchids of Malaya. *Flora of Malaya*, Vol. 1. Singapore. 759 pp.

Seidenfaden, G. (1978). Orchid Genera in Thailand VI. *Neottioideae* Lindl. *Dansk Bot. Arkiv.* 32 (2) : 1-195.

Smith, J.J. (1905). Die O.chideen von Java. *Flora von Buitenzorg*. 6 : 1-672 (Figuren Atlas 1908-1914).

———

EVALUATION OF AGRO-FORESTRY SYSTEMS UNDER SEMI-ARID CONDITIONS OF RAJASTHAN

J.S. SHEKHAWAT, N.L. SEN AND L.L. SOMANI

S.K.N. College of Agriculture, Jobner (Rajasthan)

Introduction

Trees constitute one of the most important assets and play a vital role in environmental conservation. Trees can flourish and yield abundantly in places where arable crops fail to grow *Acacia tortilis* is an important forest tree to match the unprecedented demand for firewood. Green fodder constitutes an important part of diet of farm animals. This paper explores the possibilities of taking fodder crops in between the rows of trees.

Materials and Methods

The source of the experimental material is a fifteen year old plantation of *Acacia tortilis* at the research farm of S.K.N. College of Agriculture, Jobner and a part of neighbouring area. The entire experiment consisted of seven treatments viz *A. tortilis* alone, *A. tortilis* + Bajra, *A. tortilis* + Cowpea, *A. tortilis* + Guar, Bajra sole, Cowpea sole, and Guar sole. All the three field crops for fodder were planted in June 1984 and harvested in August 1984. *Acacia tortilis* trees were harvested for fuelwood in March 1984. The yields of fuelwood and green fodder were recorded in physical units and were converted to monetary form before analysing them statistically. The entire experiment was planned in a randomised block design with four replications. The trees were harvested after leaving a stump of 45 cm from the ground level so that coppice cropping could be taken. Ten trees were selected randomly and observations were recorded on total height, length of clear bole and diameter at breast height. Besides, per cent sprout of coppice cropping of *A. tortilis* was also recorded.

Results and Discussion

A critical examination of data in Table 1 shows that the over all yield of fodder decreased by growing them in between the trees because of the shade effect of trees as compared to sole fodder crops but the agro-forestry did not affect the yield of fuelwood. Evidently introduction of fodder crops in between the rows of *A. tortilis* resulted in additional yield of fodder without any adverse effect on potential fuelwood yield These findings are in conformity with the results of Gupta and Muthana (1985) and Shukla and Sangal (1986) who also reported agro-forestry practices to be more economical than sole forestry or sole fodder cropping.

The data on the yield and monetary return presented in Table 1 show that sole crops resulted in very poor returns while growing these crops in between the rows of *A. tortilis* provided additional returns ranging from Rs. 1756 to 2106 per hectare over that of sole forestry practice and

Table 1

Biomass production and economic returns under different agro-forestry systems

Treatments	Biomass production		Monetary returns (Rs.)			Additional returns due to agro-forestry over sole forestry	Additional income due to agro-forestry over sole forestry
	Fuelwood (Q/ha)	Green fodder (Q/ha)	Fuelwood	Fodder	Total		
A. tortilis sole	746.1	—	14922.00	—	14922.00	—	—
A. tortilis + Bajra	686.1	160.0	13722.00	3200.00	16922.00	2000.00	11188.50
A. tortilis + Cowpea	726.4	125.0	14528.00	2500.00	17028.00	2106.00	12126 50
A. tortilis + Guar	690.9	140.0	13878.00	2800.00	16678.00	1756.00	11755.50
Bajra sole	—	286.6	—	5733.50	5733.50		
Cowpea sole	—	245.7	—	4901.50	4901.50		
Guar sole	—	246.1	—	4922.50	4922.50		
S. Em. ±					166 39		
C.D. at 5%					675.28		

Rs. 11188 to Rs. 12126 over and above that obtained from fodder sole crops. The results of this experiment thus provided circumstantial evidence in favour of adopting agro-forestry over that of sole forestry or sole fodder crops.

Data presented in Table 2 reveal that the average height of *A. tortilis* trees was 11 metres having 3 metres length of clear bole. The diameter at breast height (1.37 m) was recorded to be 67 cm. The results further indicated that 89.33 per cent stumps sprouts enabling to take coppice cropping.

Table 2

Mean height, length of clear bole and diameter at breast height of A. tortilis fuelwood and per cent sprouting of stumps for coppicing

Trees	Total height (m)	Length of clear bole (m)	Diameter at breast height (cm)	Per cent sprout of stumps for coppicing
1	9.55	2.05	66	
2	10.10	2.10	38	
3	11.42	3.17	61	
4	12.00	4.70	69	89.33
5	9.75	1.26	42	
6	11.25	4.25	34	
7	12.75	0.50	42	
8	10.10	4.10	61	
9	10.23	1.65	78	
10	12.00	2.50	88	
Mean	11.00	3.00	67	

Acknowledgement

Authors are highly thankful to the staff of Department of Horticulture and Dr. S.C. Bhandari for their help.

SUMMARY

A field experiment involving *A. tortilis* alone and in combination with three prominent fodder crops of arid Rajasthan viz. Cowpea, Guar and Bajra was carried out at Jobner. Sole fodder crops of Cowpea, Guar and Bajra were also taken to work out relative yield and economic returns. Results show that growing of fodder crops in between the rows of *A. tortilis* resulted in additional attractive returns of Rs. 1756-2106 per hectare in between stumps left for coppicing. There was 89.33 per cent sprout in stumps of *A. tortilis*.

अर्द्ध मरूस्थलीय राजस्थान में कृषि वानिकी पद्धतियों का मूल्यांकन

जे०एस० शेखावत, एन०एल० सेन एवं एल०एल० सोमानी

सारांश

इजरायली बबूल अकेले एवं चारे की मुख्य फसलों के साथ जैसे बाजरा, ग्वार एवं चंवले का समावेश करते हुए एक क्षेत्र परीक्षण कृषि महाविद्यालय, जोबनेर (राजस्थान) में किया गया। बाजरा, ग्वार व चंवले की फसलें अकेले उगाकर भी आमद का तुलनात्मक अध्ययन किया गया। परिणामों से ज्ञात हुआ है कि इजरायली बबूल के ठुंठों (स्टम्प्स) के बीच चारे की फसल उगाकर 1756 से 2106 रूपये प्रति हैक्टर अधिक कमाया जा सकता है। इजरायली बबूल में स्टम्प्स का फुटाव 89.33 प्रतिशत पाया गया।

References

Gupta, J.P and K D Muthana (1985). Effect of integrated moisture conservation technology on the early growth and establishment of *Acacia tortilis* in the Indian desert. *Indian For.* **111** (7) : 477-485.

Shukla, N.K. and S.K. Sangal (1986). Preliminary studies on strength properties of some exotic timbers. *Indian For.*, **112** (5) : 459-465.

RESEARCH NOTE

GERMINATION CAPACITY OF *TREMA POLITORIA* PLANCH AN ECONOMIC PLANT SPECIES

Introduction

Trema politoria (Family Ulmaceae) is a middle sized tree of approximately 9 meters in height and 60 to 90 cm in girth. It is commonly found in Sub-Himalayan ranges from Punjab to Bengal and also in Assam, Bihar, Orissa, Rajasthan and Madhya Pradesh. The species is of multi-purpose economic utility and comes up in profusion on landslips and other degraded habitats. It acts as a soil binder and hence suitable for afforestation of such areas. It's wood is used for making gunpowder and charcoal; bark yields fibre used for making ropes; fruits are made into an acidic jam and leaves are used as a substitute for sand paper to polish wood horn and ivory. Apart from variety of uses mentioned above the most important use is of leaves as a green fodder (Singh, 1982; Soni and Vasistha, 1986). The leaves are lopped once in year during winter season at the time of scarcity of green fodder.

The plant flowers during August-September and its fruits mature during October-November. Fruits are small ovoid drupe, black in colour after ripening. The seed coat is very hard and rarely permeable to water.

Material and Methods

Seeds were collected during the month of October from Maldeota situated about 18 km North-East of Dehra Dun. These were air dried and stored in glass container. To study the viability and germination, the tests were carried out both in laboratory and in earthen pots kept in open natural conditions.

In laboratory seeds were treated with concentrated sulphuric acid for 10, 20, 40 and 60 minutes period followed by 18 hrs soaking in water. These tests were carried out in petridishes in sand media at room temperature. Five replicates of 100 seeds in each dish were taken. The media was kept moist throughout the experiment and seed germination was recorded (Table 1).

Earthen pots were filled with nursery soil and also overburden from rock phosphate mines (It contains fraction of shale, chert, limestone and about 10% soil). Five replicates of 300 seeds in each case were sown in the month of April, 1987. No artificial irrigation was provided till the end of rainy season. Seed germination was observed till there was no further germination. After that regular watering was started and seed germination again recorded (Table 2).

Results and Discussion

Data from Table 1 indicates that the sulphuric acid treatment has positive effects on germination. The commencement of

Table 1

Effects of Sulphuric acid treatment on germination of Trema politoria seeds

Treatment	Time (in minutes)	Germination	Period for germination on (in days)
Cons. H_2SO_4	10	9.7	24–46
	20	21.6	28–79
	40	23.6	31–76
	60	25.0	19–41
Control	—	7.3	33–100

Table 2

Seed germination capacity in Nursery soil and mine overburden

Treatment	At the end of rainy season		Afte rainy season	
	Germinatinn (%)	Commencement of germination (days)	Germination (%)	Total germination
Nursery soil	8.2	110	11.8	20.0
Overburden	8.8	120	11.6	20.4

germination days and period for 25 per cent germination is less in case of 60 minute treatment as compared to other treatments. Results from Table 2 show that seeds have also germination capacity in natural conditions but due to hard seed coat, it is considerably lowest and delayed. Further in this experiment seeds were sown in the month of April and germination recorded during the month of September, when there were rains. Seed germination at the end of rainy season and after that was to be found more of less similar in both the nursery soil and mined overburden. These results indicate that the seed has also germination capacity in degraded soil but pre-treatment with sulphuric acid favours germination.

Recommendations

Research on identification, selection and propagation of various miltiuseful species for afforestation and socio-economic utilization is of utmost importance particularly when India's vast landmass is under threat of degradation by mining, landslides and floods etc.

References

Singh, R.V. (1982). *Fodder Trees of India.* Oxford & I.B.H. Publishing Co , New Delhi

Soni, P. and H.B. Vasistha (1986). Reclamation of mine spoils for Environmental Amelioration. *Indian For.*, **112** (7) : 621-632.

Environmental Research Station
Forest Researeh Institute & Colleges,
Dehra Dun.

H B Vasistha
and
P. Soni

CORRIGENDUM

Article "Phenological Study of Trees in Arunachal Pradesh", by B.S. Beniwal, published in *Indian Forester*, Vol. 113, No. 12, December 1987.

For	*Read*
Fig. 1 (Page 781)	Fig. 2
X-Axis : Graph showing month-wise flowering of species.	X-Axis : Graph showing month-wise fruiting of species.
Fig. 2	Fig. 1
X-Axis : Graph showing month-wise fruiting of species.	X-Axis : Graph showing month-wise flowering of species.
Page 782-83 (column 13) *Anthocephalus chinensis* HW-FR	4W-FR

GAZETTE NOTIFICATIONS

HIMACHAL PRADESH GAZETTE

The Governor of Himachal Pradesh, is pleased to order the following postings & Transfers of IFS/HPFS-II officers with immediate effect, in the public interest :-

S No.	Name of Officer.	From	To	Remarks.
1	2	3	4	5
1.	Shri B.S. Chauhan, IFS.	Director (North) HPFSC, D/Sala.	Addl. CCF (Social Forestry)	On adhoc promotion vice Shri MSL Vaidya proceeding on leave.
2.	Shri Gurmit Singh, IFS	DM, HPFSC Solan.	CF, WP Dharamsala.	On adhoc promotion. against vacant post.
3.	Shri Pankaj Khullar, IFS	DFO, Rampur	CF (PF & P) Shimla.	On adhoc promotion against vacant post.
4	Shri R.A. Singh, IFS	DFO, Rampur	Director (North) HPSFC, D/Sala.	On adhoc promotion vice Shri B.S.Chauhan
5.	Shri B.N. Ghidyal, IFS	CF, Mandi.	CF, Kullu.	Vice Versa
6.	Shri G.S. Negi, IFS	CF, Kullu.	CF, Mandi.	
7.	Shri S.C. Gupta, IFS	DM, HPFSC Kullu.	DFO (Minortoring) Shimla.	Against vacant post.
8.	Shri J S. Walia, IFS	DFO, Silva, Shimla.	DFO, Rampur.	Vice Shri Pankaj Khullar, IFS

1	2	3	4	7
9.	Shri H.C. Kingra, IFS	DM (Hqr) O/o MD, HPFSC, Shimla.	DFO, Nalagarh.	Vice Shri H C. Tej, IFS
10.	Shri R.C. Bargal, IFS	DFO, Pangi.	DM, HPSFC, Chamba.	Vice Shri D.S. Saini, HPFS-II
11.	Shri D.P. Sinha, IFS	DFO Nachan.	DFO, Publicity.	Against vacant post.
12.	Shri Sanjeeva Pandey, IFS	On return from Wild Life (Training)	DFO, Wild Life Sarahan (To join O/o the CF Rampur in the mean-time).	Shri Harish Mitter proceeding on Wild Life (Training) on 1.8.87.
13.	Shri Avtar Singh, IFS	DFO, Lahaul.	GM, R&T Factory, Bilaspur.	Vice Shri S.S. Negi, IFS
14.	Shri Shamsher Singh Negi, IFS	GM, R&T Factory Bilaspur.	DFO, Nachan.	Vice Shri D.P. Sinha, IFS
15.	Shri Ajay Kumar, IFS	Depot Officer Badala	DFO, Kotgarh.	Vice Shri H.R. Arya, IFS
16.	Amar Chand Sharma IFS	Depot Officer, Dhanotu.	DFO, Spiti.	Vice Shri H.C. Thakur, HPFS-II
17.	Shri K.S. Negi, IFS	DFO, Rhoru.	DFO, Silva.	Vice Shri J.S. Walia, IFS
18.	Shri H.R. Artya, IFS	DFO, Kotgarh.	F.U.O. O/o Pr. CCF, HP, Shimla.	Against a vacant post.
19.	Shri H.C. Tej, IFS	DFO, Nalagarh,	DM, HPSFC Solan.	Vice Shri Gurmit Singh, IFS
20.	Shri M.P. Singh, HPFS-II	DFO (WP) Dharamsala.	DM, HPFSC D/Sala.	Vice Shri G.S. Rana, HPFS-II
21.	Shri Jagdish Chand, HPFS-II	ACF, Kullu.	DFO, Rohroo.	Vice Shri K.S. Negi, IFS.

1	2	3	4	5
22.	Shri S S Maan, HPFS-II	Attached with CCF, (P & D) Shimla.	DFO, Soil (Hqr.) Shimla.	Against vacant post.
23.	Shri Bagi Rath Sharma HPFS-II	ACF Karsog.	Depot Officer, Badala.	Vice Shri Ajay Kumar, IFS
24.	Shri D S Saini, HPFS-II	DM, HPSFC, Chamba.	HP, SFC, Ltd. Bilaspur.	Aganist a vacant post.
25.	Shri S.C Sood, HPFS-II	TA toCF, Shimla, Shimla Circle.	DM (Hqr.) O/o Director (Marketing) HPSFC, Shimla.	Vice Shri H.K. Sharma, HPFS-II
26.	Shri G S Rana, HPFS-II	DM, HPFSC, Dharamsala.	DFO, Palampur.	Vice Shri R.A. Singh, IFS
27.	Shri H.K. Sharma HPFS-II	DM (Hqr) O/o Director (Marketing) HPFSC, Shimla.	DM, HPSFC, Kullu.	Vice Shri S C. Gupta, IFS.
28.	Shri Prem Chand HPFS-II	TA to CF (SF) Shimla.	DFO, Pangi.	Vice Shri. R.C. Bargal, IFS
29.	Shri D.P. Choudhary, HPFS-II	SDM, HP SFC Chopal.	DFO, Lahaul.	Vice Shri Avtar, Singh, IFS.
30.	Shri B.C. Thakur, HPFS-II	DFO, Spiti,	Depot Officer, Dhanotu.	Vice Shri Amar Chand Sharma, IFS.

———

ZOO

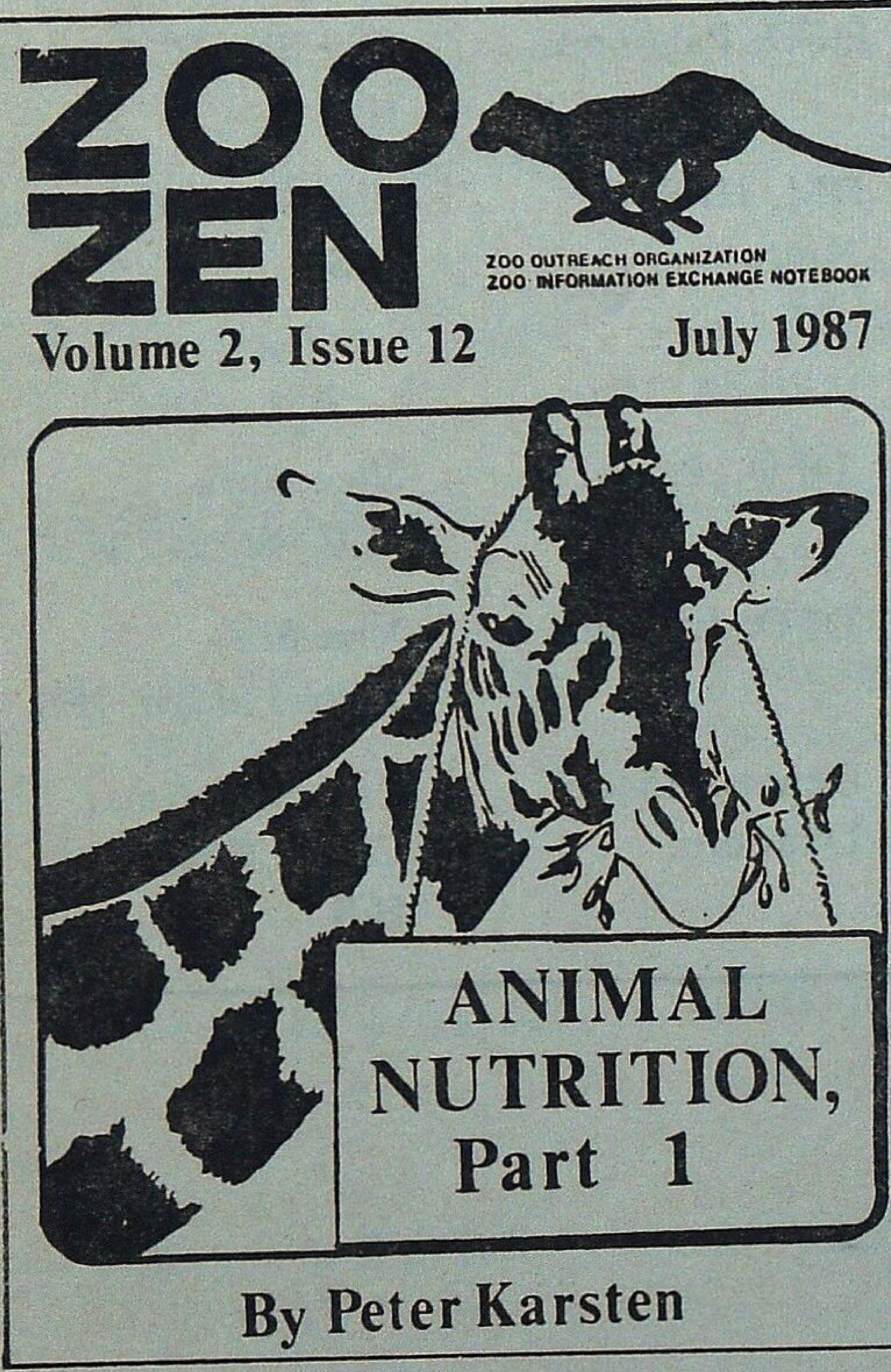
ZOO OUTREACH ORGANISATION

Pioneer House, Peelamedu, Coimbatore– 640 004 (Tamil Nadu)

ZOO'S PRINT

Monthly news (print) of zoos and captive breeding centres all around the world, but particularly from India. Original articles and reports. Birth and Hatching news, International calender of symposia, helpful hints, serialised zoo books, reprints of relevant articles from some of the world's best zoo magzines.

ZOO ZEN and PASHU PREM



Simple xeroxed booklet consisting of single subject material from non-published, in-house, or otherwise unavailable or difficult-to-obtain matter normally from foreign zoos. Occasional issue features valuable out-of print Indian documents pertaining to zoos. Recent issues include : International Species Inventory System Update, Pangoline Husbandry, North American Studbook for Burmese Brow Antlered Deer.

Every third or fourth issue may be PASHU PREM, Hindi magazine for zoo keepers. Translations of simple article on animal care carefully selected from various sources. Original articles also. Meant for keepers but others find it interesting as well.

SUBSCRIPTION RATES :

Send to above address.

ZOO's PRINT	(One year...12 issues)	Rs. 100/-	(May include membership if desired)*
	(Life...ours, not yours)	Rs. 1000/-	(May include one-year membership; life subscription to journal).
ZOO ZEN and PASHU PREM	(One year .. 12 issues)	Rs. 150/-	

* All memberships must be approved by the office bearers.

FRI Publications

FOREST RESEARCH INSTITUTE & COLLEGES, DEHRA DUN

1. Silviculture of Indian Trees, Vol. V
   (Symbol No. PFRI-194)
   Price Rs. 193.50 or £ 22.57 $ 69.66 cents.

2. Indian Forest Record (New Series)
   Forest Influence Vol. 3, No. 1—1984
   (Symbol No. PFRI-213)
   Rs. 2.95 or £ 0.34 $ 1.07.

Available from :

The Controller of Publications,
Deptt. of Publication,
Civil Lines, Delhi–110 054

PROVIMI
SALTLICKS

FOR CATTLE, GOAT. SHEEP, HORSES,
DEERS, TIGERS, PUMAS, ZEBRAS &
Other Forest Animals.

CONTAINING : Iodine
Iron
Copper
Cobalt
Manganese
Magnesium
Zinc
Sodium

India's Top Selling Lick !

Provimi Salticks are of Vital Importance for the Health of your Livestocks

Manufactured By : **Provimi Products Private Ltd.**
Regd. Office : BANGALORE,
Factory & Administration,
3-F, Mill Road,
GOBICHETTIPALAM-638 476
Tamil Nadu.
Phone : 2593, 2493, 2707 & 2720.

With best compliments

from

WOOD PRESERVERS PVT. LTD.,

F-27, MIDC INDUSTRIAL ESTATE,
NAGPUR-440 016 (Maharashtra).

GRAM : WOODTREAT

Phone : Fact. 7451, 7210
Resi. 23131

Manufacturers for :

"Railway Sleepers, Pre-cut structures, Marine Constructions materials, Fabricated and engineered wood products, Wood Preservative Copper Chrome Arsenic Composition, Kiln drying Pressure Preservation treatment, Ammunition Boxes, Wooden Pallets, Packing cases and Crates."

"Enquiries particularly solicited for unusual and difficult items."

The Similipahar Forest Development Corporation Ltd.

(A Government of Orissa Undertaking)

Baripada

Our Corporate goal is

★ To preserve and protect the Similipahar Forest ;

★ To improve and enrich the growing stock, and to nurse back to health the degraded patches in the project area ;

★ To improve infrastructure like roads, godowns, rest house and staff quarters; and

★ To intensify collection of M.F.P.

We have grown from a turnover of Rs. 43 lakhs during 1979-80 to Rs. 580 lakhs during 1981-82.

WHATEVER YOUR NEED

There is a Species of

ANDAMANS TIMBERS

TO SUIT YOUR REQUIREMENTS

CONTACT :

1. The Chief Conservator of Forests,
Andamans & Nicobar Islands,
Port Blair.

2. The Deputy Conservator of Forest
(Depot Division)
Andamans Govt. Timber Depot,
3-A, 2nd Floor, Auckland Place,
Calcutta-17.

3. The Assistant Conservator of Forests,
(Depot Division)
Andamans Govt. Timber Depot
Marshalling Yard, Port Trust, MADRAS.

Available in India for the very First Time with Chain Brake Attachment

McCulloch. The Professional Dealer Choice

1. Bar length available 24," 28" & 32".
2. All essential spares and after Sales Service readily available.

Please Contact :
"SOLE DISTRIBUTOR in India".

M/s. Indiana International

2001, Ugger Sen Street, Bazar Sita Ram, Delhi-110 006
Phone : Office : 734868 Resi. : 224-2737 Gram : "POWERCHAIN"
Res. Address : F-42, PREET VIHAR, DELHI-110092

CORBETT NATIONAL PARK, RAMNAGAR (NAINITAL) U.P.

Beckons you to its land of Roar, Trumpet and Song.

Have a date with nature in its superb magnificence and enjoy the thrill of observing wild animals roaming freely in the vast wilderness. A paradise for bird watchers and anglers.

Elephants, chital, sambar, hog deer, barking deer, wild boar, magar gharial etc. and incredibly large varities of numerous beautiful birds. There is also very good chance of seeing tiger, panther or a bear in their natural habitat.

* Elephant rides arranged at reasonably low rates.
* Still photography permitted free; cine photography on nominal payment.
* Angling permitted on moderate charges in the Ramganga river which abounds in famous fighting fish 'Mahaseer'.
* High watch towers and tree top machans available for wildlife viewing.
* Picturesque scenery of the park provides an ideal holiday resort.
* Wildlife films screened daily free of charge.
* Well furnished Rest Houses and lodges available at various tourist centres inside the Park.
* Regular bus service available from Ramnagar to main tourist centre (Dhikala).

Nearest Rail Head – Ramnagar (N.E. Rly)
Nearest Bus stop – Ramnagar
} 50 kms from Dhikala

Eor other information contact or write to :

The Field Director, Project Tiger
Corbett National Park,
Ramnagar (Nainital), U.P. – 244715
Phone : 32, 189 Office
76 – Residence

OR

The Chief Wildlife Warden
17-Rana Pratap Marg,
Lucknow (U.P.)
Phone : 46140 – Office
46817 – Residence

ONE UNIT PLYWOOD

EQUALS

Three Units Sawn Timber

Use Plywood and Conserve Timber

★

THE INDIAN PLYWOOD MFG. CO. LTD.

9, WALLACE STREET, FORT,

BOMBAY-400 001 (Maharashtra)

Factories at : Dandeli, Dharwad, Talaguppa,

Subramanya and Hungarcutta.

VISIT : Palamau National Park

Famous for the abundance and variety of wildlife—Tiger, Panther, Elephant, Gaur, Samber, Spotted deer, Barking deer and numerous species of beautiful birds,

Picturesque Scenery.

*A place of historical importance - the
*old and the new Palamau Fort of Chero Kings.

*Ideal holiday resort.

*Well furnished tourist Lodges and Forest Rest Houses with catering arrangement.

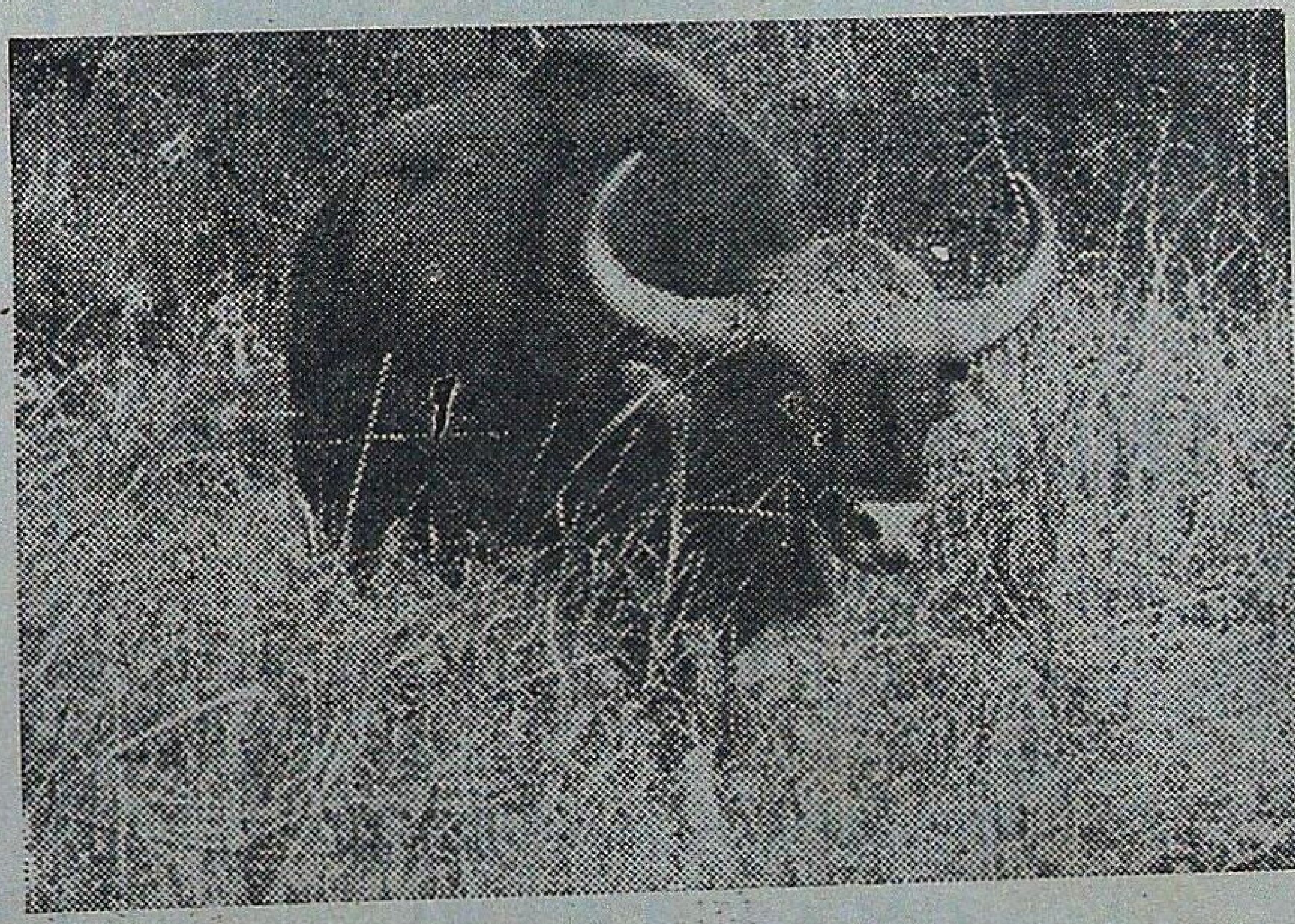
*Beautiful Watch Towers, tree - top and Hide-outs-all connected by roads.

*Remains open throughout the year.

*Snaps and movie permitted free of charge.

*Approachable by road and rail–26 kms from Daltonganj 12 kms from Chhipadohar Rly. Station. Well connected by roads with comfortable Bus service.

Nearest Airport—Ranchi – 175 kms.



For further particulars write to :

THE FIELD DIRECTOR, PROJECT TIGER,

Palamau Tiger Reserve,

P.O. Daltonganj, Bihar, (India)

We have pleasure to introduce ourselves as :

* Producers of Round Timber for Veneering and Saw Mill.
* Manufacturers of Tea chests and Commercial Plywood
* Suppliers of Sawn Timber and Furniture.
* Cultivators of Coffee, Cardomom, Rubber, Cocoa, Tea and other cash crops.
* Manufacturers of Match and Polythene Bags.

Arunachal Pradesh Forest Corporation Limited

(A Govt. of Arunachal Pradesh Undertaking)

DEOMALI

Regd. Office :
ITANAGAR – 791 111
Distt. Sabansiri
(Arunachal Pradesh)

Head Office :–
P.O. DEOMALI – 786 629
Distt. Tirap
(Arunachal Pradesh)

Associate yourself with the

INDIAN FORESTER

as

Advertiser—Subscriber

or

Contributor

GUJARAT STATE FOREST DEVELOPMENT CORPORATION LIMITED
FOR THE WELFARE AND UPLIFT OF TRIBALS.

We endeavour to create a better tomorrow for tribal and rural poor masses through our activities such as :

... Collection and marketing of over fifty Minor Forest Products.

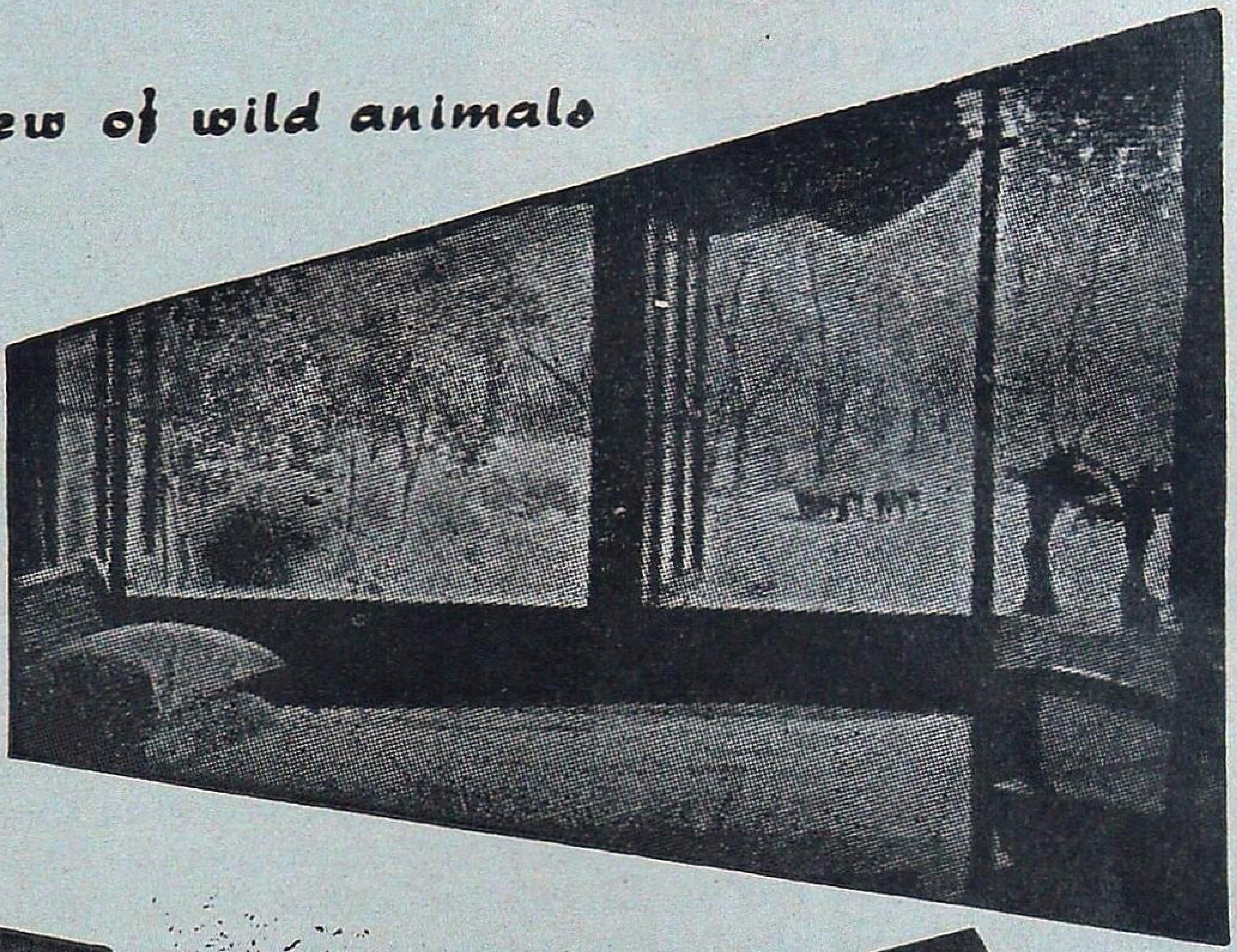
... Establishment of 'Vanil Udyog – An Integrated Wood Working Unit in tribal area.

... Establishment of Cottage Industries.

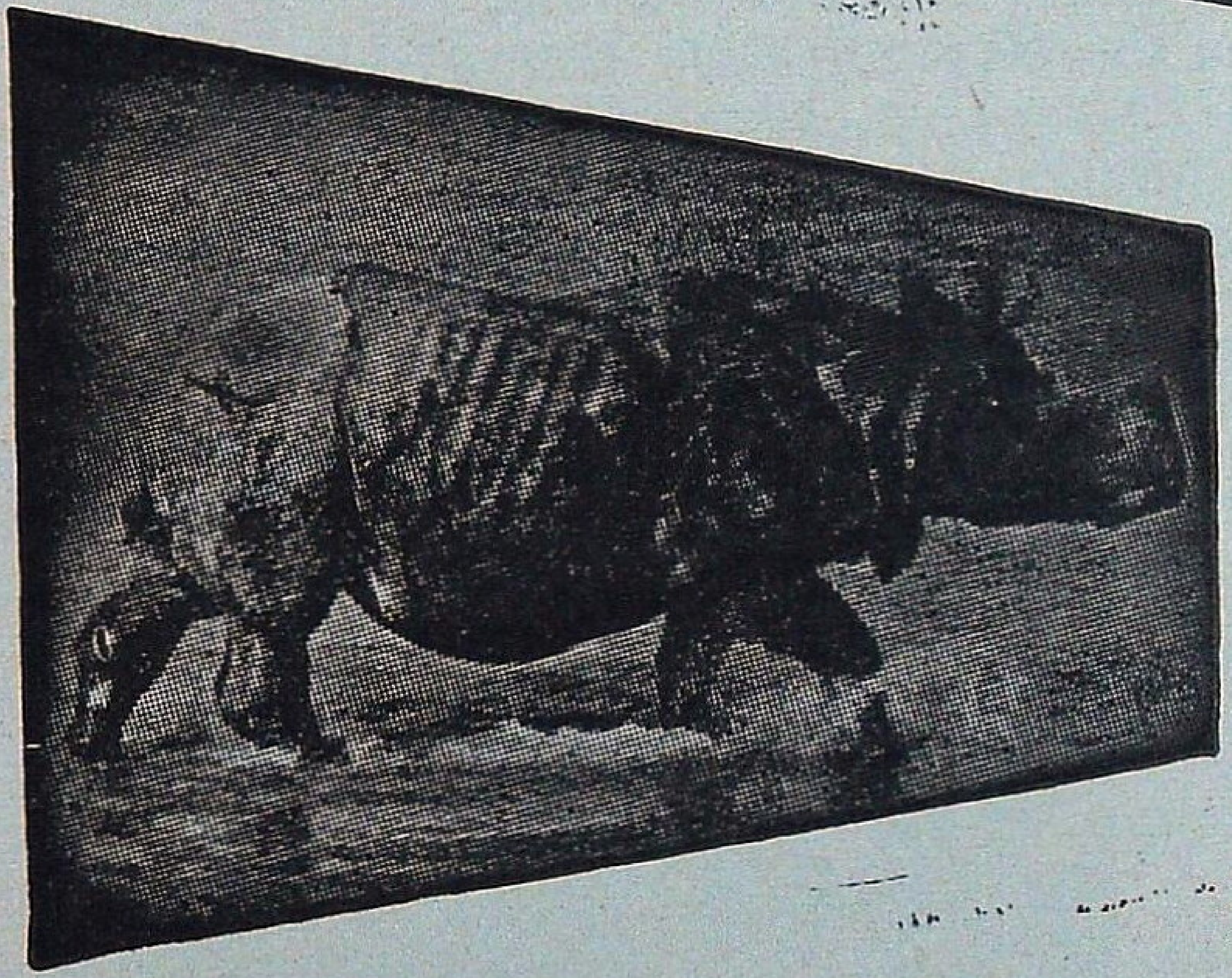
... Intensive Plantations with the help of institutional finance.

GUJARAT STATE FOREST DEVELOPMENT CORPORATION LIMITED,
'Vanganga', 78, Alkapuri Society,
Vadodara 390 005.

Have a bedroom view of wild animals



VISIT



JALDAPARA WILD LIFE Sanctuary

* Home of One-horned Rhinoceros.
* Gaur, Elephants, Tigers
* Varieties of Deer and other Animals.
* Furnished Tourist Lodges with full Catering arrangement.
* Approachable by Road, Train and Air.
* Jeep available.

Please contact :

DIVISIONAL FOREST OFFICER
WILD LIFE DIVISION–II
JALPAIGURI
(WEST BENGAL)

OR

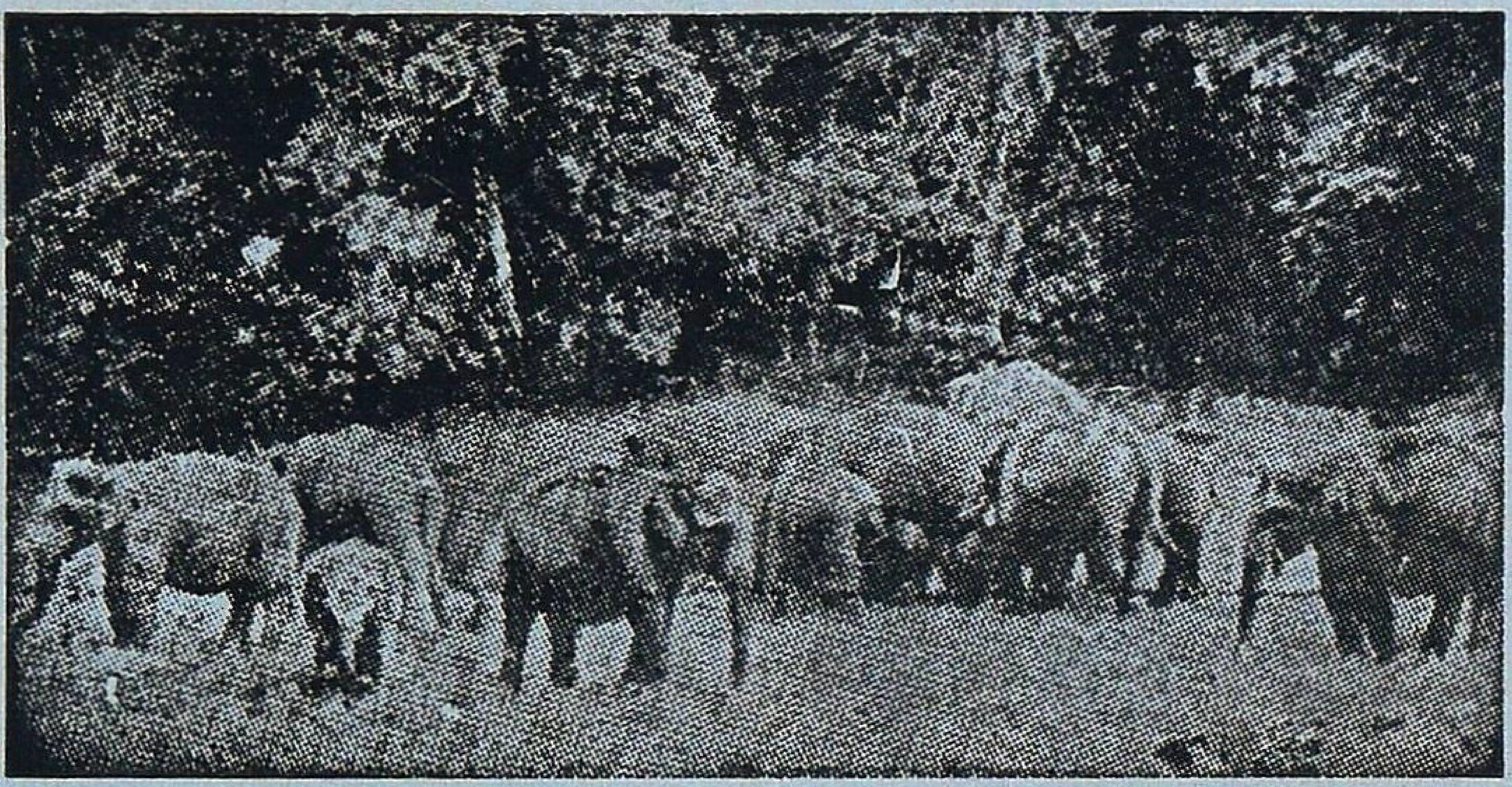
FOREST UTILISATION OFFICER
8, Lyons Range, CALCUTTA
[Phone : 22-2774]
WEST BENGAL

VISIT **PERIYAR TIGER RESERVE**

THEKKADY (KERALA STATE)
(OPEN ALL YEAR)

OBSERVE

Elephants, Gaur, Sambhar Leopard, Wild Dogs, Black Langur, The Giant Malabar Squirrel, Birds and other indigenous Fauna.



—

Hotels :
Western Style—Aranya Nivas
Indian Style—Periyar House.

(Accommodation in Hotels reserved by Managers)

†Frunished Forest Rest Houses at Thannikudy, Mullakudy and Manakavala.
†Motor Boats available for most enjoyable cruise in the lake.
†Elephant rides.
†Approachable by Air or Rail up to Cochin or Madurai.

Distance to Thekkady by roads is 190 km from Cochin, 145 km from Madurai and 110 km from Kottayam.

For further particulars contact :—WILD LIFE PRESERVATION OFFICER
Thekkady P.O., (Kerala) Telephone : KUMILY 27

FOR ROPING AND PLANTING TREES

POLYTHENE BAGS

GUSSETTED-PERFORATED OR PLAIN

Contact for Immediate Supply

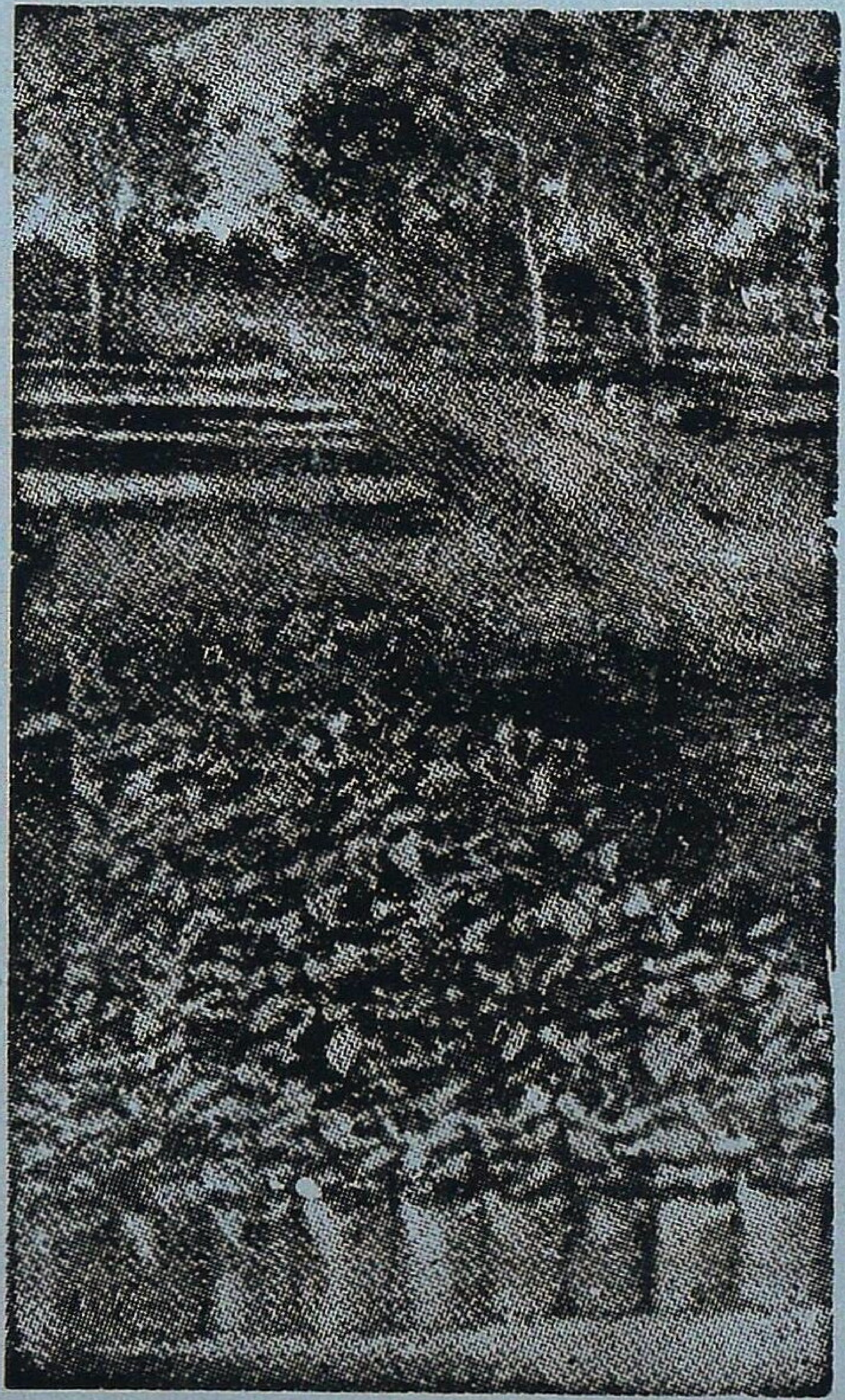
KANPUR PLASTIC COMPANY

111/423, Ashok Nagar, KANPUR-208 012

Phones { Office : 243721 & 244992
Resi. : 245954 Gram—KANPLASTIC
Fac. : 244993 Estd.—1956

———

ALL SIZES OF POLYTHENE BAGS IN REQUIRED GAUGE & SPECIFICATIONS AVAILABLE



Himachal Pradesh State Forest Corporation Ltd.

(A Govt. of Himachal Pradesh Undertaking)

SHIMLA

HPFSC marches ahead towards a better tomorrow under the dynamic guidance and leadership of Hon'ble Chief Minister Shri Vir Bhadra Singh.

Himachal Pradesh State Forest Corporation has taken long strides under the benevolent guidance of our Chairman Prof. Chander Kumar, Hon'ble Minister of State for Forests.

* With complete nationalisation of forest working viz; timber operations, resin tapping etc. both in Govt. and private forests, there is complete elimination of contractor' agency. Modernisation of timber operations has reduced conversion wastage considerably and the incidence of organized illicit felling in forests is completely under control.

* To ensure gradual reduction in use of valuable coniferous timber for packing cases, effective steps have been taken for distribution of Card Board Cartons and purchase of Wooden Packing Cases from adjoining States of Punjab and Haryana.

* Stocks of timber extracted by Corporation are being supplied towards developmental works by catering to the requirements of Indian Railways, Director General of Supplies and Disposals, Defence Organisation and other Govt. Indenters. Sale of timber stocks is being organized through well established sale depots conveniently located.

* The annual turn-over has registered a significant increase from its inception from 1974-75 being Rs. 2.43 crores to Rs. 44.83 crores in 1986-87.

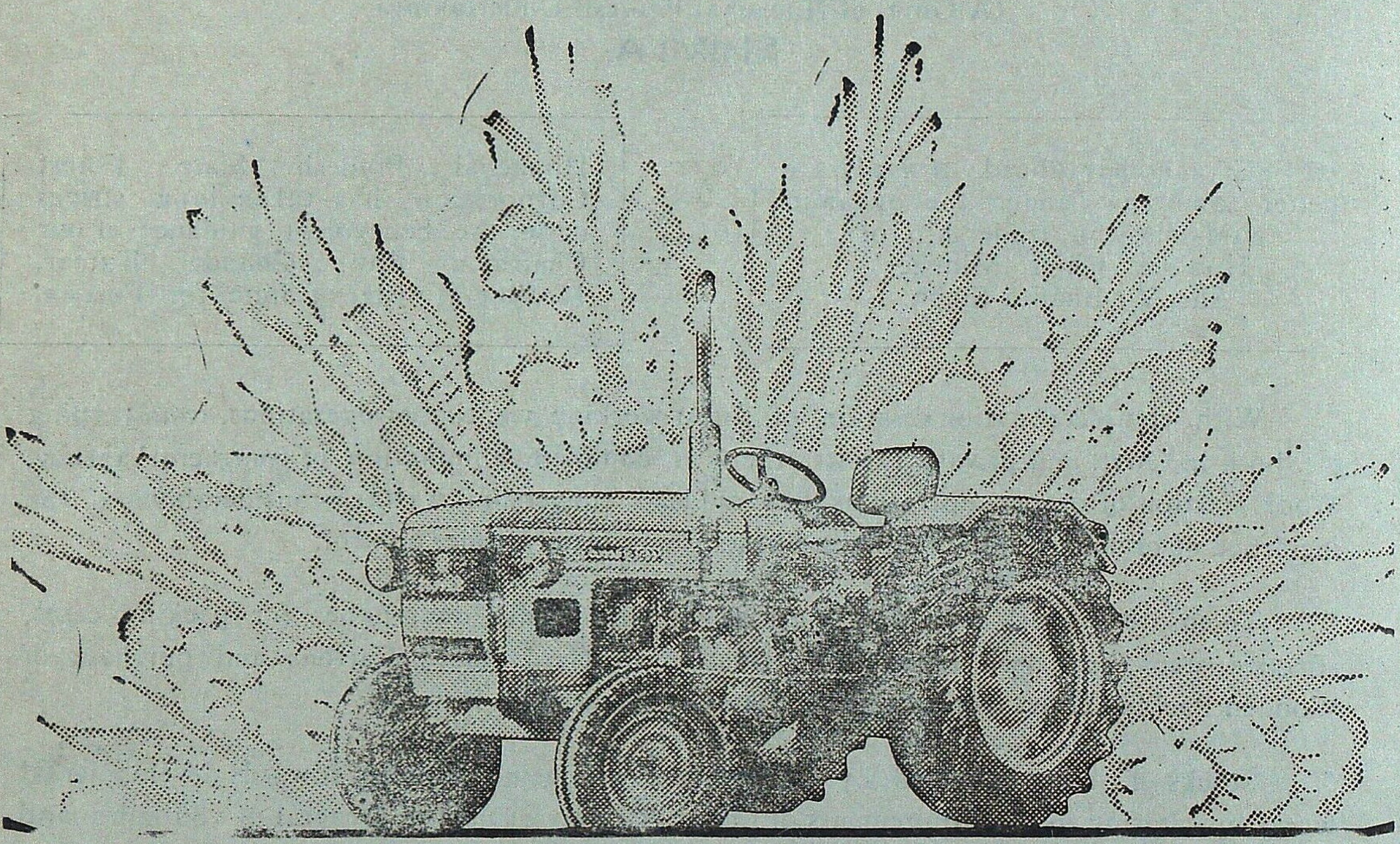
* In order to maximize operational efficiency, following steps have now been initiated :

a) Replacement of old fleet of trucks for minimising transportatton time of timber to depots;

b) Analysis of financial data through computer net-work to ensure prompt and efficient working.

c) Providing incentives to officers and staff through prompt action on service matters like confirmations, job rotation vis-to-vis career planning including specialized training.

(V.P. Mohan)
Managing Director.



The True Test of a Tractor is on the Field. Not Just in its Looks.

The true assessment of a tractor should be based on its actual performance. And on this count, no other tractor comes close to HMT.

HMT can drive any kind of equipment on your field. Because, its PTO shaft gives it six different speeds. In addition to a standard speed.

HMT is the only tractor that can do two jobs at the same time. Like preparing the final seed bed and levelling the field. Because it offers mixed control.

In HMT, the PTO shaft can operate even while turning: a useful facility for equipment like combine harvesters. Because it has a 'dual clutch'.

Plus its hydraulic brakes enable you to stop the tractor instantly, and without much strain. And its anti-slip system automatically overcomes the slippage. In all other tractors, you will have to do it manually. And there are 12 gears which enable you to operate implements more efficiently. And with less fuel.

Available in 25 hp, 35 hp, 55 hp. And special models for special needs. Like Rice Special, Puddling Special and Hauler.

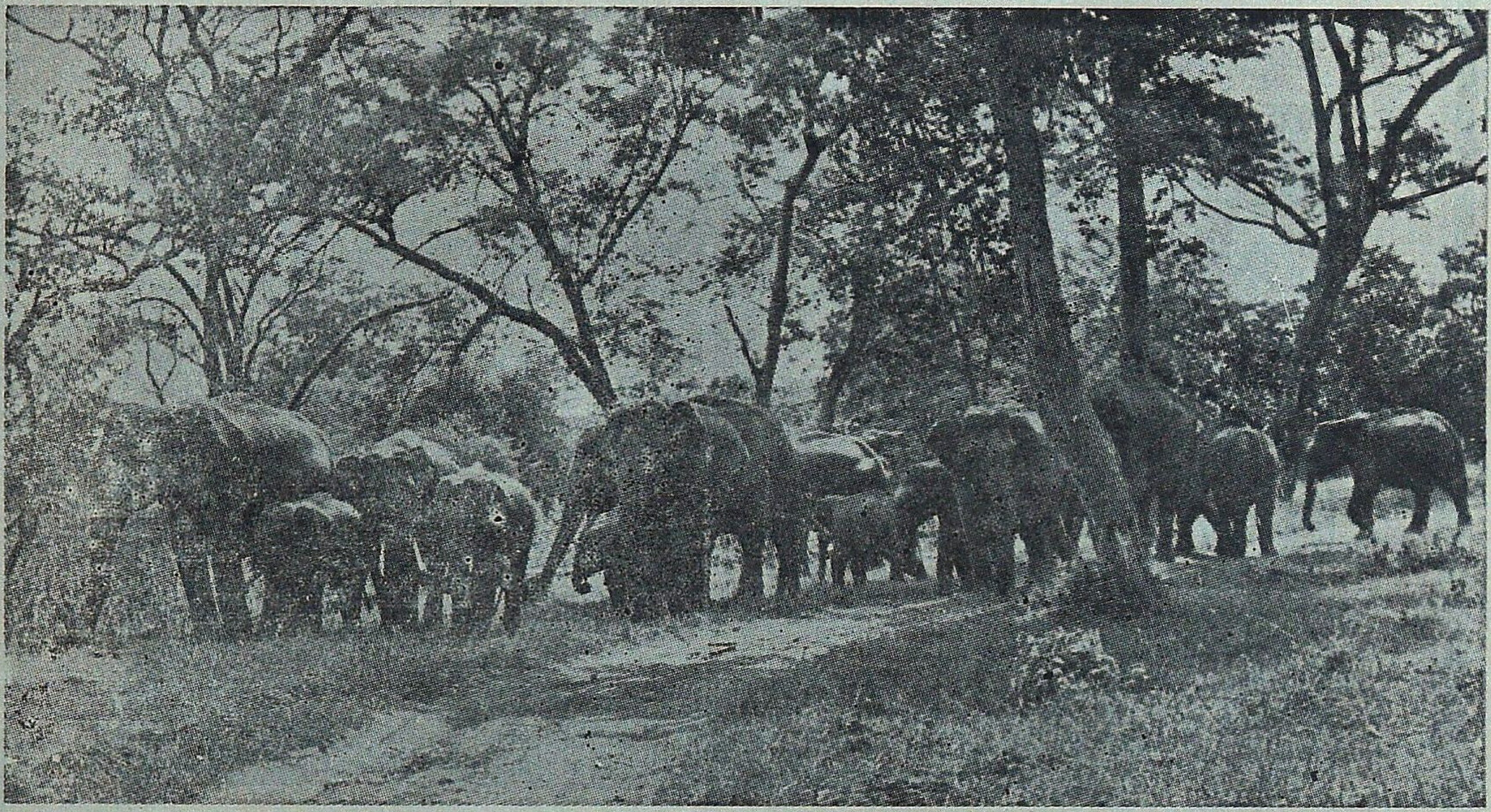
hmt

HMT TRACTORS: UNBEATABLE FOR ALL JOBS.

Rediffusion/HMT/5363a

BANDIPUR TIGER RESERVE

KARNATAKA



Lovers of nature and Wildlife the world over find it well worth their while to linger on in Bandipur. More famous as a Tiger Reserve, Bandipur enjoys reputation as a wildlife sanctuary that stretches as far back as 1931. The Mysore Maharajas; benign rulers and farsighted visionaries understood the compelling necessity of protecting the fauna, avifauna and flora from the thoughtless foreys of marauders. Today 874 sq kms. of the Bandipur National Park makes up the Tiger Reserve which is one of India's finest parks.

But Tigers, native to the country and the most magnificent of the great cats are saved from threatened extinction. An abundant variety of fauna: the panther, wilddog, Sloth bear, Sambar, Chital, barking deer, fourhorned antelope, common langur; avifauna like peacock, grey jungle fowl, crested hawk, eagle and reptiles such as crocodiles, Python, Vipers, etc., roam this park freely.

Hundreds of spotted deer greet the visitors right at Bandipur campus, at night times as they step out of comfortable cottages.

A herd of elephant majestically moving single file through a patch in the jungle can be viewed on an elephant ride. If one is lucky he can watch in absolute silence, of course—a herd of Indian 'bison' or gaur, locking horns a few meters away.

Nature at its bountiful best Bandipur bestows the soothing solace of jungle retreat off the beaten track and far from the madding crowd.

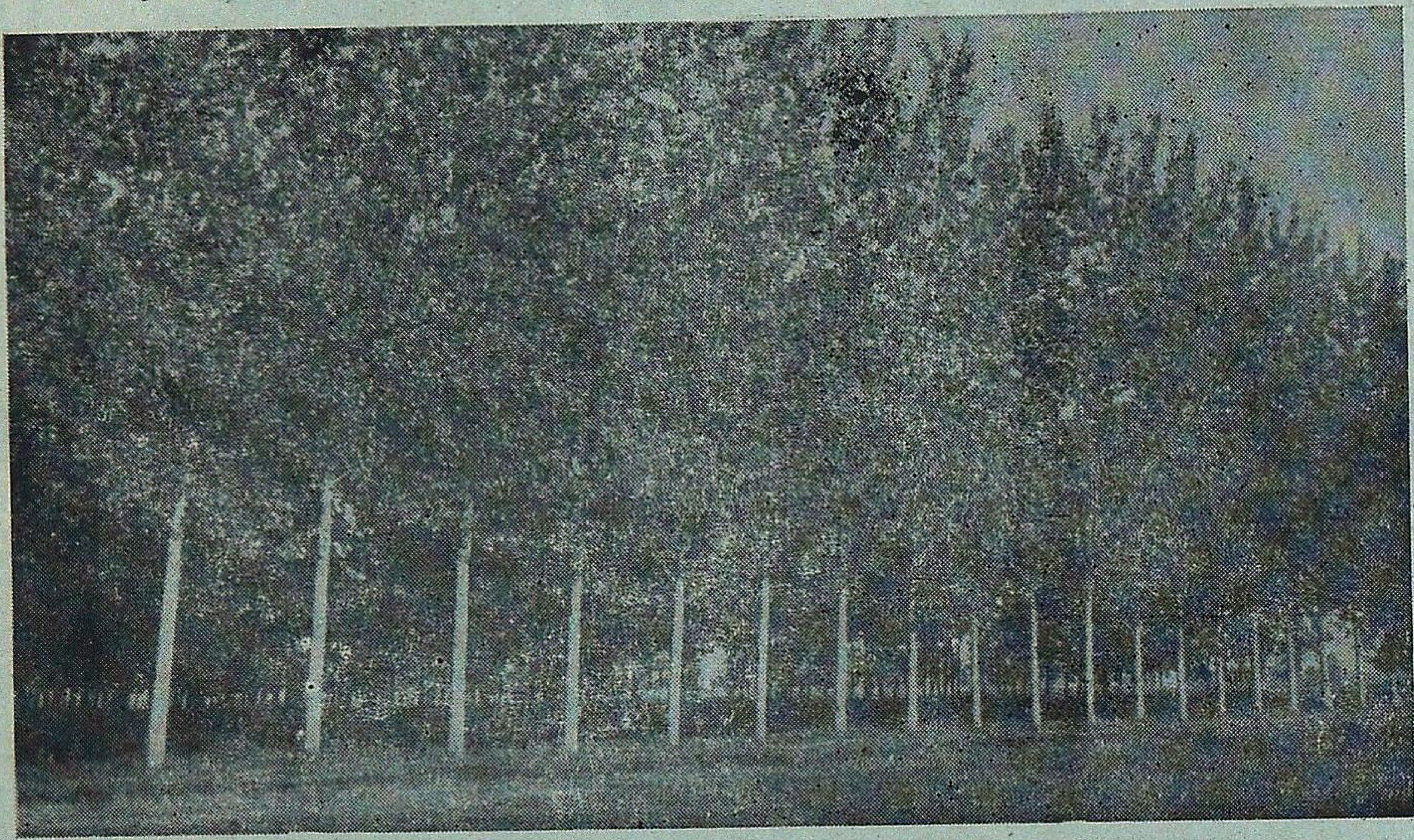
For further particulars, please contact

The Field Director
'Project Tiger'
Government House Complex
MYSORE – 570 010
(Karnataka – State) India
Telephone No. 20901

GROW POPLARS FOR PROSPERITY

AND YOU WILL HELP AMELIORATE THE ENVIRONMENT TOO.

The **WIMCO-NABARD** Farm Forestry Project in U.P., Punjab and Haryana offers you the benefits of combining forestry with farming to increase your returns.



WIMCO provides:

* High quality plants of selected Poplar clones.
* Extension services and technical guidance till harvest.
* Assistance in securing bank loans and insurance cover for Poplar trees.
* Buy back guarantee at assured minimum price at 8 years rotation.

Over 5,000 farmers have planted more than 45 lakh trees from 1984 to 1988.

Districts covered

U.P. : Moradabad, Bareilly, Meerut, Badaun, Shahjahanpur, Saharanpur, Ghaziabad, Pilibhit, Lakhimpur Kheri, Bijnor, Bulandshahr, Rampur, Nainital, Aligarh, Etah, Bahraich, Hardoi, Muzaffarnagar.

Punjab : All districts.

Haryana : Karnal, Ambala, Kurukshetra, Sonepat.

Just write to us, or visit our office nearest to you, for more information.

WIMCO

WIMCO LIMITED

No. 5, Block E, Local Shopping Centre, Masjid Moth, New Delhi-110 048.
Phone: 6415141, 6462747, 6462319.

Moradabad : 9, Awas Vikas, Civil Lines. Ph: 23292
Bareilly : P.O. Clutterbuckganj. Ph. 75011-14
Meerut : F-194, Shastri Nagar. Ph: 73202
Chandigarh : 224, Sector 18-A. Ph: 20558
Karnal : 843, Sector 13, Urban Development Estate.

Mizoram Forests Through The Years

During the British period i e. from 1890 till the year 1952, the management of Inner Line Reserved Forests was done under the supervision of Superintendent of District. The District was put under 'Excluded Area' and practically no Statutory Act or Law were enforced to manage the Forests Practically nothing had been done. The Inner Line Reserved Forests was constituted under the Assam Forest Regulation comprising an area of 559 sq kms.

When the Mizo District Council came into being in 1952, the management of all the Forest other than the State Inner Line Reserved Forests was handled by the District Council. Thence the District Council started to make its own Forest Wing. Under the District Council one Forest Division called Aizawl Forest Division was created comprising the then whole area with headquarters at Aizawl. In fact during the time of the then District Council, most accessible areas of the forests had been overtapped for earning more revenue and due to population pressures.

In the early 1960's the first plantations were raised by the District Council in different centres. During the year 1966 1968, practically no plantation could be raised due to political disturbance in the Mizo District.

After Mizoram became a Union Territory in the year 1972, the Union Territory Government formed one more Forest Division with headquarters at Lunglei.

The present position of Mizoram Forest Department may be summed up as follows :

The Mizoram Forest Department is headed by the Chief Conservator of Forests. The field work has been taken up with ten (10) Territorial Divisions. In addition to this, six (6) Functional Divisions have been set up. There are now three (3) Circles namely—Southern Circle, Northern Circle and Research & Development Circle. The Government of Mizoram has already constituted three Wildlife Sanctuaries in order to preserve its vanishing Wildlife. Four more Wildlife Sanctuaries are being proposed which are likely to be constituted very soon. The Mizoram Forest Department has created 1,00,029 hectares of plantation upto 1987 as against 967 hactares before it attained U T. Status.

Issued by :
CHIEF CONSERVATOR OF FORESTS,
MIZORAM : AIZAWL.

KARNATAK STATE FOREST INDUSTRIES CORPORATION
USHERS IN THE PROGRESSIVE ERA FOR FOREST PRODUCE !

Ecological imbalance is one of the most important hazards enveloping our Country.

In Karnataka, K.S.F.I.C. is progressively involved in eliminating this hazardous element by undertaking scientific logging operations and helping erase the contract system. So that there exists a cleaner and healthier environment around us.

KSFIC's long standing activities consist of :

Supplying L.D.P.E. Polythene bags/sheets for nurseries of the Forest Department, Corporations, Local Bodies, Zilla Parishads, Packers, etc.

Regular Public auctions of sawn timber in various sizes for builders, Merchants, Contractors, etc, from their saw mills at Dandeli and Shimoga.

Supplying treated sleepers to the Railways and treated wooden poles to the Electricity Board from their Wood Preservation Plants at Shimoga and Mangalore.

Supplying high quality handlooms for the weaving industry fabricated at Shimoga and Dandeli saw mills.

Fabricating and supplying furniture to Government Departments, Corporations, Societies and Institutions. Furniture orders are also accepted.

Supplying Firewood at reasonable rates to the common man from 51 firewood depots. Solar and steam heated seasoning kilns have been built by KSFIC for seasoning timber at subsidised rates, thus encouraging the practice of seasoning wood before use.

Soon, KSFIC will diversify to market Flush doors and Block Boards from its manufacturing unit at Bangalore. It also has plans of marketing pulverised sandalwood powder from sandalwood white chips and spent wood in the immediate future.

THE KARNATAK STATE FOREST
INDUSTRIES CORPORATION LTD.
32/2, Crescent Road,
Bangalore—560 001
Ph. : 29611 Grams : INDFOREST

TAFCORN

Stands for Quality Products

Pulpwood, Cashewnuts, Sandalwood Oil, Sandalwood Powder and Chips, Picture Varnish, Shellac Glue, Shellac Compound, French Polish, Thinner, Honey etc.

For your requirements, Please contact:

Managing Director,
TAMIL NADU FOREST PLANTATION CORPORATION LIMITED,
(A Government of Tamil Nadu Undertaking)
34/A, Promenade Road,
Cantonment, Trichy-620 001

ENJOY your Holidays in Orissa

The place that will enchant you most is
NANDANKANAN
With its
SYLVAN
SURROUNDINGS

BEAUTIFUL LAKE and boating toy train, elephant ride,
INDIAS' LARGEST LION SAFARI in natural environment.
White tigers, black panthers, varieties of deer, bear, South American green Iguana, rhinos, gibbon, monkies, crocodiles and birds.

For details please contact :

The Director
Nandankanan Biological Park, Orissa,
145-Saheed Nagar, Bhubaneswar-751007
Phones : Off-53840, Res. 53660, Park-51580

WILDLIFE ORGANISATION
FOREST DEPARTMENT-ORISSA

ROSEWOOD/TEAK

WE CAN SUPPLY :

- Veneers (decorative) of Rosewood, Teak, White Cedar etc.
- Rosewood Guitar Finger Boards, Guitar Neck, Billiard Cues, Knifehandles, Parquet floor tiles, Guitar quality veneer, etc.
- Any quantity of Kiln seasoned sawn sizes of Teak, White cedar, Anjily etc.
- Factory made doors (Frames and shutters), windows, ventilators of Teak, Anjily, Pillamaruthu, Venteak and Malaysian timber species. Also plywood and particle board panel inserts in wooden shutter frames.
- Decorative doors of Rosewood, Teak and White cedar.
- Veneers (commercial) of Pali, Punna, Karanjily, Silver oak, red cedar etc.
- Core and lipping material for flush doors.

For details contact :

Managing Director,
KERALA STATE WOOD INDUSTRIES LTD.,
P.O. Box No. 9, Nilambur 679 329,
Malappuram, Kerala. Phone : 378, 254.
OR
Marketing Manager,
KERALA STATE WOOD INDUSTRIES LTD,
'Karunalayam' Wynad Road,
Calicut 673 001, Kerala. Phone : 62629 and 61113,
Telex 0804-246 KWIL IN, Gram : 'WOODLAND'

Punjab State Forest Development Corporation Limited

REGD OFFICE : KOTHI No 165, SECTOR 36-A, CHANDIGARH. Tel. : 40586

Punjab State Forest Development Corporation Limited has established the use of eucalyptus wood in building construction, truck body building, furniture making, battens, wooden crates, fabrication of packing cases, tool handles etc. Besides its use in paper and pulp industries the eucalyptus wood is also suited for chip / particle / fibre / ply-boards. Investigations got done from the Indian Plywood Industries Research Institute, Bangalore have shown that the eucalyptus timber grown in Punjab is suitable for making common grade plywood. Entrepreneurs desirous of setting up wood based industries can do so as huge quantity of eucalyptus wood is available at reasonable price in the State. The Corporation has wood seasoning facilities at its Phillaur complex.

Recently, the Corporation has established the use of eucalyptus on commercial scale in fabrication of packing cases and manufacturing door and window frames.

For further details, please contact the Managing Director, Punjab State Forest Development Corporation Limited, Chandigarh.

Y P CHOWDHRY
MANAGING DIRECTOR

Madhya Pradesh Forges Ahead ; Forestry for the People

Madhya Pradesh is the 'Guardian State' of India. Upper catchment areas of important rivers lay here. They are to be kept tree-clad.

Forests conserve Soil and Water besides ameliorating environment. Plantation targets from all sources stand at about two lakh hectares including Wasteland Development Programme. People's participation in afforestation programme is encouraged through Social Forestry which covers the whole State. M P. Forests are a great source of non-tax revenue. They generate eight-crore man-days of annual employment. Forestry-activities provide jobs to weaker sections of society in lean season.

Fuel-Fodder-Timber-Bamboo-Tendu Leaves-Sal-seed, Gums etc—all are derived from our Forests.

Forests harbour Wild Life too :

M.P. has 11 National Parks and 31 Game-Sanctuaries covering more than 11 per cent of the forest area.

Save Forests : Save Wild Life.

Issued by :

Director General of Forests,
Madhya Pradesh.

NOW
AVAILABLE
ISI MARKED.

FLUSH DOORS

(Solid core type)
Commercial
&
Decorative

Why look for
solid timber for your doors & windows ?

use
rain water & insect resistant. Phenol bonded.
BLOCK BOARD & FLUSH DOOR
for longer life, strength and durability
at a much cheaper cost.

AVPL

ALOKUDYOG VANASPATI & PLYWOOD LTD.
Authorised Controller :
WEST BENGAL FOREST DEVELOPMENT CORPN. LTD.
(A GOVT. OF WEST BENGAL UNDERTAKING)
6-A, RAJA SUBODH MULLICK SQUARE, CALCUTTA-700 013

GRAM : VANUDYOG
PHONE : 26-5226

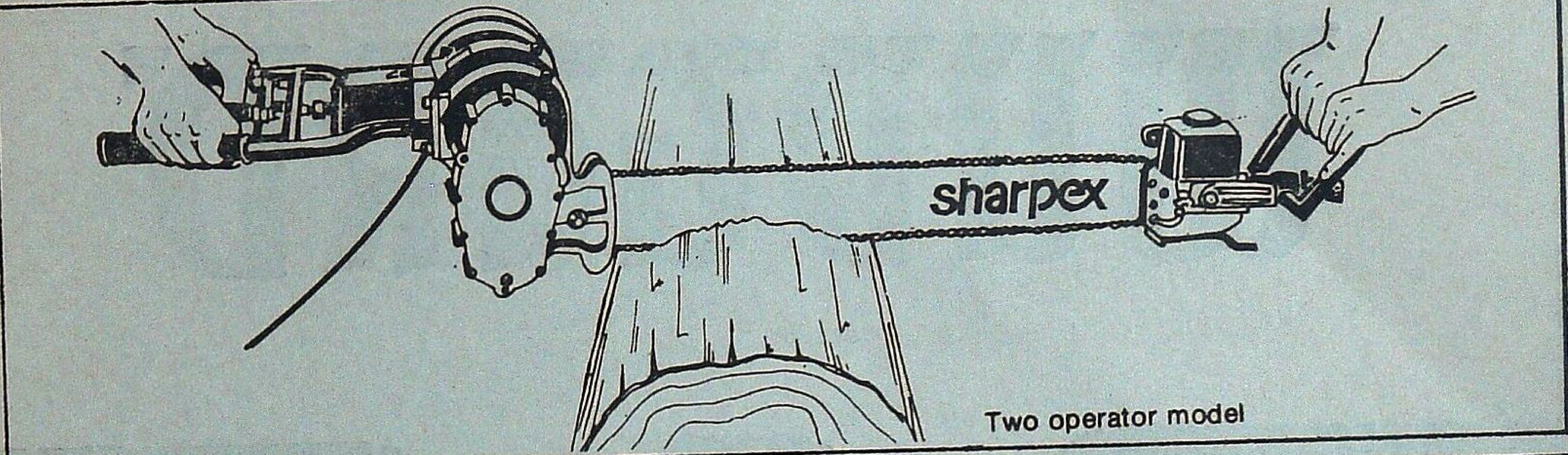
The Moments of Life Time Experience await you

IN SASAN–GIR
you have a date with the
King & Queen
of Animal World

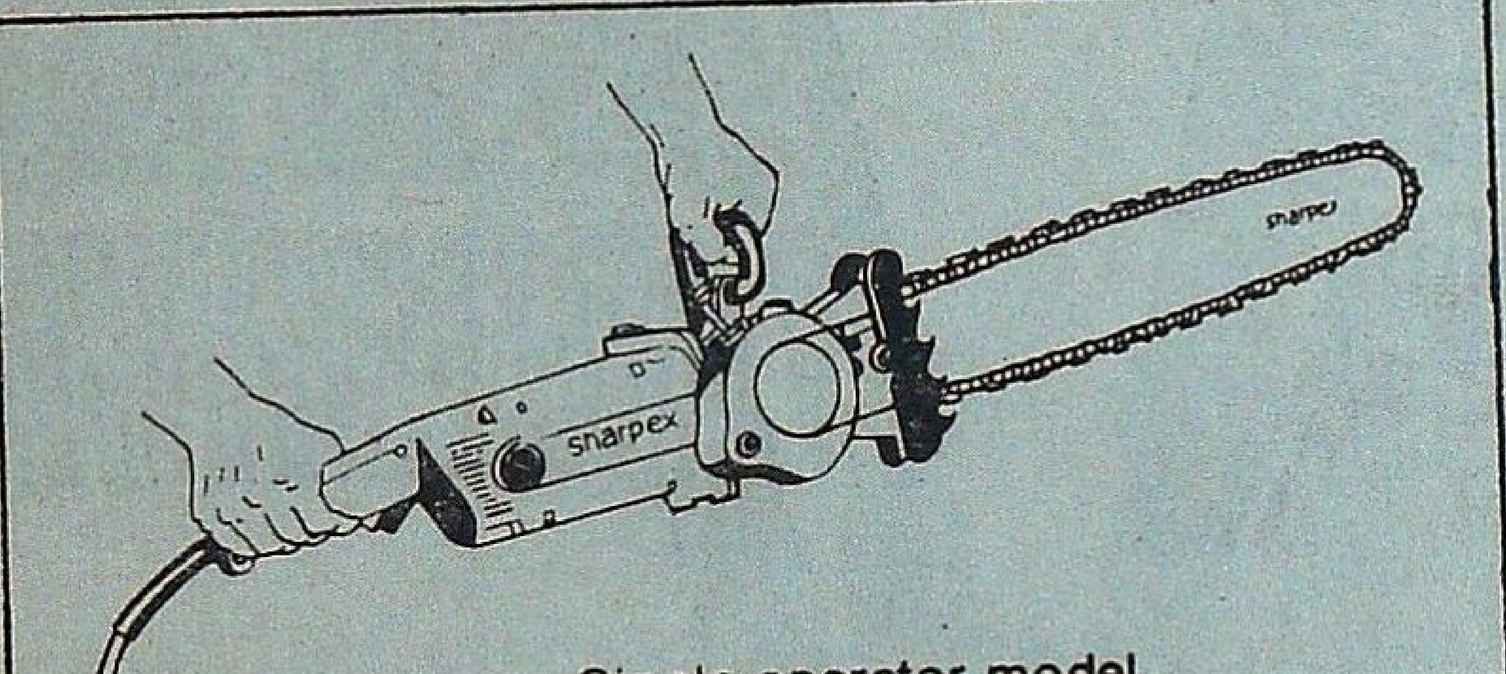
The most Majestic Royal Animal species—

The Rare Asiatic Lion

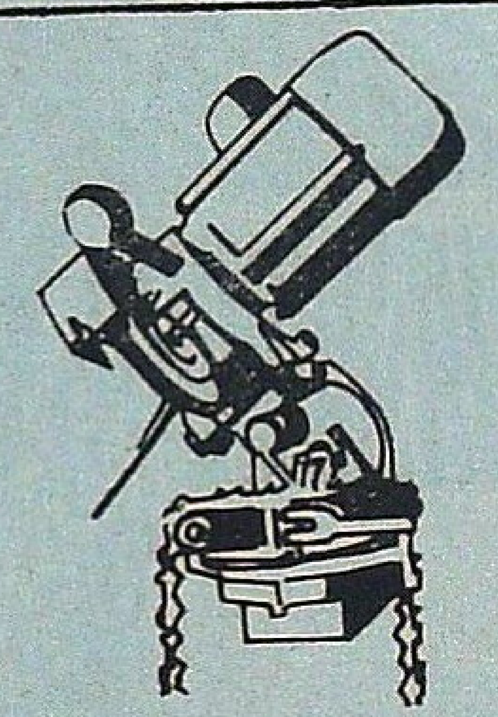
For more details contact :
Deputy Conservator of Forest,
Wild Life Division,
P.O. Sasan-gir - 362 135
Distt. Junagadh, Gujrat.



Two operator model



Single operator model


Chain Sharpener

What is common between all
GOVERNMENT SAW MILLS ?

Fastest cross cutting of wood

Useful for production units of Veneer, Plywood, Match Splints etc.

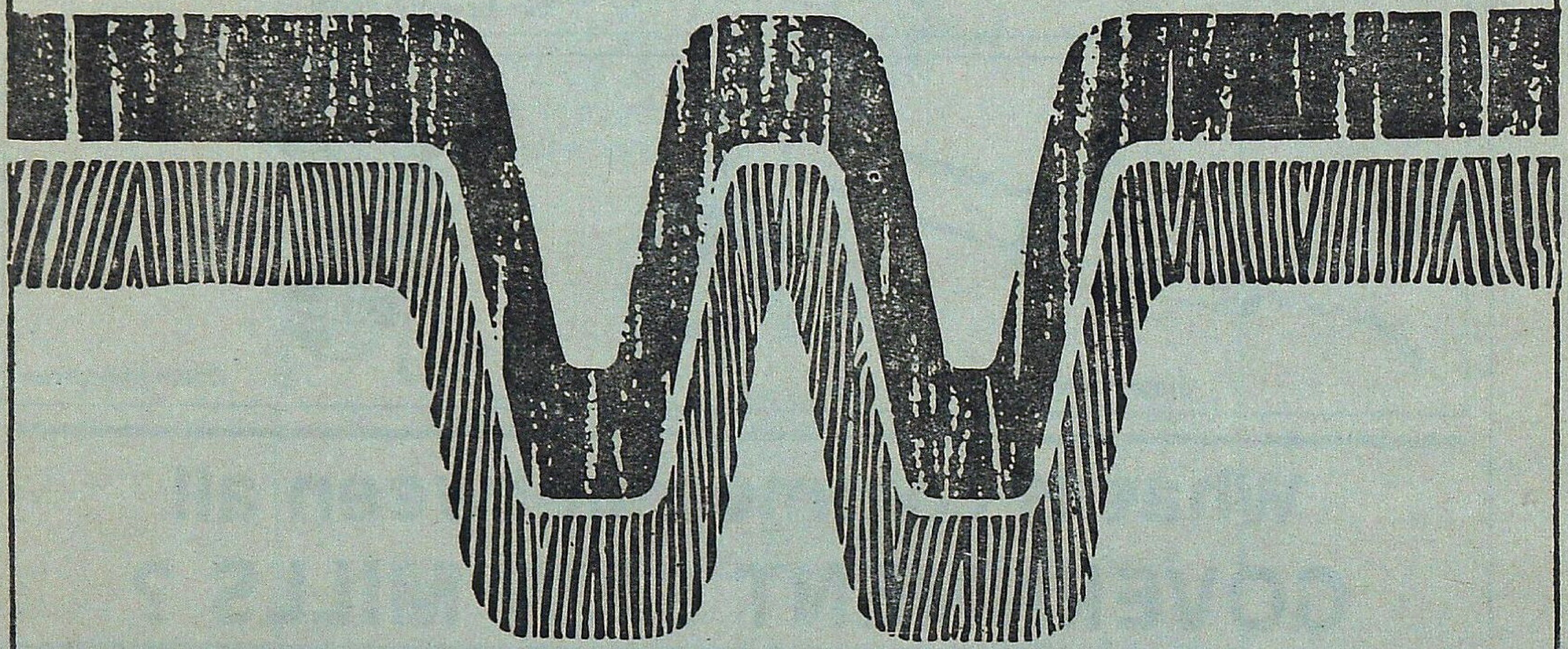
- 20 times faster than manual operation.
- Two operator model/Single operator model.
- Portable and mobile models available.
- Centrally balanced motor gives 100% accuracy.
- Long lasting imported chain.
- Most reliable after sales service.
- Backed by more than 30 years of industry experience and R & D.
- More than 10,000 units working successfully all over the country.
- Being exported to various foreign countries.
- Being proprietory item immediate purchase possible.
- Single operator model ideal for eucalyptus felling.

The need for
sharpex ®
CHAIN SAW

SHARPEX ENGINEERING WORKS
Plot No. 1 to 5, Near L Type Sheds
GIDC Industrial Estate, Odhav,
Ahmedabad - 382 415

Tel. : 887342, 886075
Gram : CHAINSAW-ODHAV

WUDGARD



THE NEW NAME IN WOOD PRESERVATIVES

- WUDGARD For All Applications — In Homes, Factories, Transmission Poles, Industrial Products, Packages.
- WUDGARD Can be Applied By Dipping, Brushing, Spraying or Pressure/Vacuum Impregnation As Per IS : 401 Specification and Some Sophisticated Grades For Special Care.
- WUDGARD Wood Preservatives, manufactured in India by

INDROL

INDROL Lubricants & Specialities Ltd.

Head Office: 91, Walkeshwar Road, Bombay-400 006
Branches at Bombay, Calcutta, Delhi and Madras
Depots and Consignment Stockists — All Over India

Norvicson

KHANGCHENDZONGA NATIONAL PARK

OF

SIKKIM 850 sq. km.

The Majestic Mountain

"The Mount Khangchendzonga"

which forms the crowning glory

of our country

forms an abode of

many endangered animals found in Sikkim.

Save wildlife of Sikkim.

Wildlife Circle
Forest Department
Government of Sikkim.

With Best Compliments from :

Karnataka Forest Development Corporation Limited

(A GOVERNMENT OF KARNATAKA UNDERTAKING)

Regd. Office : No. 6, Kumara Park East, Bangalore-560 001. (Karnataka)

LARGEST GROWERS AND SUPPLIERS OF
INDUSTRIAL RAW-MATERIALS IN
EUCALYPTUS WOOD
EUCALYPTUS CITRIODORA OIL
INDIAN LAVANDER OIL

RAW RUBBER (NATURAL)
CENTRIFUGED LATEX 60% DRC (ISI MARKING)
RMA GRADE SHEETS
CREPE SHEETS
SCRAP RUBBER

MANAGING DIRECTOR

for quality

PLEASE STEP TO—

Nocte Timber Company Limited

A Subsidiary of

Arunachal Pradesh Forest Corporation Ltd.

(A Govt. of Arunachal Pradesh Undertaking)

P.O. DEOMALI, TIRAP DIST. VIA-NAHARKATIA,

PIN-786629 (Arunachal Pradesh)

Phones Dl. 27, 29, 30.

Manufacturer of :—

Hot Pressed resin bondeds, Commercial Plywood,

Decorative Plywoods, Shuttering Plywoods,

Nocte Special, Flush Doors

&

Block Boards.

FOREST SERVES ALL

* We have sale centres at Salt Lake Calcutta, Durgapur, Bankura, Purulia and Midnapore for superior quality Sawn timber and Plywood for making doors and windows. Black Board and Readymade furniture are also sold at reasonable price.

* If you intend to purchase readymade door, window, flushdoor and furniture please contact the Salt Lake Sale Centre at Calcutta, Govt Saw Mills at Siliguri or the Saw Mills at Madarihat. We will meet your requirement or arrange supply of materials of your choice.

* Good news to the pan chewers also, we are producing good quality of Khair (Katha) and selling this in polythene packets of 10 Gms., 25 Gms., and 100 Gms. from our sale centres. If any chewer has used this once he will never forget to purchase again and again.

* Pure Honey, Citronella Oil, Orchid and various flowers are also available from the sale centres.

West Bengal Forest Development Corporation Limited

(A Government of West Bengal Undertaking)

6A, Raja Subodh Mullick Square (7th floor)

Calcutta-13

RULES OF CONTRIBUTIONS

1. Contribution should be sent to the Honorary Editor, *Indian Fo.·ester*, Forest Research Institute, P.O. New Forest, Dehra Dun, or to any Member of the Board of Management or Central Editorial Board and should be written legibly in ink *preferably* typed.

2. The Central Editorial Board does not hold itself responsible for the opinions expressed by the authors.

3. The Central Editorial Boaru reserves the right of accepting or rejecting any contribution and of making suitable alterations and amendments, without assigning any reason.

4. Contributors are invited to sign their contributions in preference to affixing to them a *nom de plume*, since professional opinion naturally carry more weight when their author is known. All communications must be authenticated by the name and address of the writer being communicated to the Honorary Editor, whether intended for publication or not.

5. Contributors will be supplied with 30 extra copies of their contributors, together with any illustrations accompanying them, free of charge. Additional copies will be charged for at the rate of twenty paise per page per reprint. *Contributors desiring extra copies should state the number of reprints required when sending articles, otherwise they will not be available.*

6. No payments will be made to members of Govt. organisation for their contributions to the *Journal* but it will be open to the Honorary Editor, to make payments for articles accepted from the outside public.

INSTRUCTIONS TO CONTRIBUTORS

Title—This should be brief, carefully chosen, and indicative of the contents of the article. It should be inserted on the top of the first page in block capitals.

Authors—The name of the author and his status should appear immediately under the title, but need not be entirely in capitals.

Introduction—An introduction presenting the general object of the work, and the scope and importance of the problem is, desirable.

Presentation—The matter should be neatly written, or typed double or treble spacing, on one side only of fullscape size paper with a left hand margin of 4 cm and margins of 2.5 cm at the top and bottom of each page except the opening page where the top margin should be 4 cm. The sending of the contributions in triplicate is recommended.

Summary—A condensed account of the important contents of the article should be at the end of article. The summary should be self-explanatory, complete and clear in itself, avoiding, as far as possible, technicalities.

Illustrations—The number of illustrations should be kept at a minimum as their reproduction is costly. Photographs and drawings should, if possible, be made to the correct proportion of the printed page of the magazine (20 cm by 15 cm). Nothing should be written in pencil or ink, or type-written on the back of illustrations as they cause trouble in reproduction. Photographs and illustrations should not be pinned or swen with thread as such pine holes reproduce in photography. The former should be in black and white, with pronounced contrasts and glossy finish; the later should be neatly drawn in Indian ink on white thick paper or drawing paper. Graph paper should preferably have black co-ordinate lineson white background. Captions should be typed or written on separate strips of paper and attached with colourless adhesives to the back of the prints. The approximate place where the illustrations are to be inserted should be indicate in the text, and the illustrations should be serialy numbered. In mailing illustrations should be placed between cardboards held together by thin thread or rubber bands.

Copyrighted pictures or photographs from commercial photographers should not be sent.

Punctuations—Authors should pay special attention to punctuation as this greatly aids the reader in understanding the author clearly; if this is left to the editor, a wrong punictuation made by him may alte the author's intended meaning of a sentence.

Citations—The Bibliography should be given at the end of the article on separate sheet of paper and should be typewritten double-spaced throughout. Reference to a citation in the text should be made by means of the author's name followed by a reference number in parentheses. In the bibliography the ctartion should be preceded by the reference number. The citation will consist of the serial number, the autho aof name and initials (in large and small capitals), the year of publication, the title of the article, the titls'ari the book, paper or periodical, volume number and date of issue and the page numbers, thus:

Hamilton, A.P.F., (1947). Farm Forestry in India. *Indian For.*, 74 (3), 84–88

Corrections—Authors are requested to see that their typescripts incorporate all corrections they desire to be carried out as no revisions are permitted by the press in the proof stage and any resetting involves heavy cost.

Capitals—Normally, typewritten or handwritten matter should show where capitals are to be used. If a whole wordor line has to be printed entirely in capitals the original should also be so written. To indicate italics a single straight line should be drown under the matter concerned in the original text.
For detailed instructions see the editorial in the *Indian Forester* of May. 1950.

-2 தை 1988

THE

INDIAN FORESTER

VOLUME 114 FEBRUARY, 1988 NUMBER 2

ELEPHANTS AT PLAY IN PERIYAR TIGER RESEARVE (KERALA)
Photo—G.N. Adhikary ... Front Cover

CONTENTS

ARTICLES

PILOT SURVEY OF FUEL CONSUMPTION IN RURAL AREAS—V
N.M. Misra, A.K. Mahendra and M.Y. Ansari 57

GERMINATION AND NURSERY TECHNIQUE OF FOUR SPECIES OF *FICUS*. S.N. Rai, H.C. Nagaveni and H.S. Anantha Padmanabha ... 63

AN EVALUATION OF *EUCALYPTUS* INTRODUCTION TRIALS AT NEW FOREST, DEHRA DUN M.G. Gogate and U.D. Dhaundiyal ... 69

VEGETATIVE PROPAGATION OF *EUCALYPTUS*.
K. Gurumurti, H.C.S. Bhandari and D.S. Negi 78

RELATIVE RESISTANCE OF PINES TO CERCOSEPTORIA NEEDLE BLIGHT IN INDIA. Sujan Singh and S.N. Khan 84

AN INTERESTING CASE OF EPIPHYTISM OF *EUPHORBIA NERIIFOLIA* LINN. FROM GUJARAT K.V. Billore 89

OBSERVATION ON SPIDER PREDATION ON TERMITE'S ALATES.
Sushil Kumar 91

FIRST RECORD OF *MIMOSA PUDICA* LINN. AS HOST OF *KUSMI* LAC *KERRIA LACCA* (KERR.) FROM NAMKUM, RANCHI.
B N. Sah and R.D. Pathak 93

ZEUXINE CLANDESTINA BL. (ORCHIDACEAE) – A NEW RECORD TO INDIA. A. Nageswara Rao 95

EVALUATION OF AGRO-FORESTRY SYSTEMS UNDER SEMI-ARID CONDITIONS OF RAJASTHAN.
J.S. Shekhawat, N.L. Sen and L.L. Somani 98

RESEARCH NOTE 102

GAZETTE NOTIFICATIONS 105

CENTRAL EDITORIAL BOARD

R.V. SINGH, I.F.S. (*President*), G.P. MAITHANI, I.F.S. (*Hony. Editor*)
P.P. MALHOTRA, I.F.S., P. KESWANI, I.F.S.
Dr. RAMESH DAYAL

Edited by G.P. Maithani, I.F.S. Honorary Editor, Indian Forester (Director, Forestry Research, Forest Research Institute & Colleges, Dehra Dun), Published by R.N. Biswas, I.F.S., Business Manager, Indian Forester, (Senior Research Officer, Documentation and Bibliography Sec. Silviculture Branch, Forest Research Institute & Colleges, Dehra Dun) and Printed by S.K. Arora at Print World, Dehra Dun.

Registered No. **D.N. 36**